PRELIMNARY DRAINAGE DESIGN REPORT

For

GFP Stayton Fire Staging Facility

Prepared for:

City of Stayton, Public Works Department
311 N. Third Avenue
Stayton, Oregon 97383

Date:
January 2022

Site Location:
1319 W. Washington Street, Stayton, Oregon

Prepared by:

Project Delivery Group, LLC
200 Hawthorne Avenue SE, Suite A-100
Salem, Oregon 97301

REGISTERED PROFESSIONAL
ENGINEER
15716
OREGON
JANUARY 21, 1992
LEE NORTH BRENNAN

RENEWS: 12/31/2023

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Project Overview and Description

Size and Location of Project

This report reflects the proposed GFP Fire Staging Facility to be located at 1319 W. Washington Street, In Stayton, Oregon. The Project Site encompasses approximately 0.51 acres.

Brief Description of Project Scope and Proposed Improvements

The Project consists of developing two buildings; paved and graveled parking, storage, and access areas; concrete walkways; and landscaped areas. Two retention basin basins will be utilized for stormwater management. The Project is being designed to City of Stayton Design Standards, to address the 10- and 100-year 24, hour design storm events. The calculations demonstrate that infiltration through the retention basins will be sufficient to address both the 10- and 100-year, 24-hour design storm events.

Description and size of the watershed draining to the site

The Site is located in southwesterly portion of Stayton on the North Side of W. Washington Street. The Site generally slopes from north to south, with grades between 0 and 2 percent.

There are three on-site drainage basins for the Project: Basin A encompasses approximately 13,325 square feet (sf), including retention basin AB, and represents the westerly portion of the Site. Basin B represents the northern middle of the Site and encompasses approximately 4,045 sf ; and Basin C represents the easterly portion of the Site, includes retention basin C, and encompasses approximately 4,870 sf. Storm water run-off from Basins A and B will be collected and discharged into retention basin AB. Stormwater run-off from Basin C will drain into retention basin C. A site map illustrating the drainage basin is provided in Appendix A.

Review of the Site did not indicate any areas where surface waters from adjoining properties are discharging onto the Site.

Escape route for the 100-year storm

The storm water hydrology analyses performed for this Site indicates that the two preliminarily designed retention basins have adequate hydraulic capacity (i.e., storage and percolation) to manage the 100-year, 24-hour storm event without overflow.

Methodology

Depth to groundwater

A geotechnical analysis, percolation tests, and a review of depths to groundwater (based on well logs obtained for properties in proximity to the Site) were performed by Rapid Soil Solutions, Inc (RSSI). Copies of their reports are provided in Appendix B. Groundwater was not encountered in any of the shallow soil borings advanced. A review of well logs indicate static water levels ranging from 5 to 15 feet below grade surface. Retention basins have been preliminarily designed with a depth of 3 feet, maintaining a minimum of 2 feet of distance to projected high groundwater elevations. Groundwater elevations are expected to fluctuate seasonally in accordance with rainfall conditions and are not expected to approach surface elevation. As recommended by the City Engineer, further percolation tests and depth to groundwater measurements will be performed in late March/April to confirm the shallow soil percolation rates and depths to groundwater during the projected highest groundwater elevation period of the year to ensure that stormwater management using retention basins with high infiltration rates will provide the stormwater management needed for the Site, as demonstrated in this preliminary design report.

Description of soil types and any other geologic features impacting stormwater infrastructure design

Per the Natural Resource Conservation Service (NRCS) Soil Survey, the site consists predominately (100.0%) of Sifton gravelly loam (St, hydrologic soil group B). A copy of the NRCS soils report for this site is provided in Appendix C. There are no other geological features impacting stormwater infrastructure design for the site.

As per the geotechnical investigation and infiltration testing work performed by RSSI (copy provided in Appendix B) the testing work illustrated an infiltration rate of approximately 13.75 inches/hour in the area and at the approximate bottom depth of Retention Basin AB, and 27 inches/hour in the area and at the approximate bottom depth of Retention Basin C. For preliminary design purposes, a conservative rate of 50% of the lower measured infiltration rate of 13.75 inches per hour (corresponding to 6.8 inches/hour) was utilized in the retention basin modeling work performed.

Analysis

Computational methods and software utilized

The TR-55 method Hydrograph Type 1A, 24-hour Storm was used to model the required design storms. HydroCAD modeling software (version 10.10-7a) was used to perform the hydrology analyses for the site and to size the stormwater facilities. From NOAA Atlas 2, Western U.S. Precipitation Frequency Maps, for Stayton, Oregon the precipitation associated with storm frequency are as follows:

- 2 year, 24-hour storm (2.5 inches)
- 10 year, 24-hour storm (3.5 inches)
- 100 year, 24-hour storm (4.5 inches)

Design assumptions

All elevations used in the modeling work were based on the preliminary design elevations, with an assumed groundwater elevation of 440, and an infiltration rate of 6.8 inches per hour.

A conservative assumed post-development time of concentration of 5 minutes, representing the time from the initial start of the storm to when surface water run-off would reach the retention basin either by direct run-off or piped conveyance, was utilized for the hydrology analyses

Hydrology Calculation and Modeling

Using the various surface areas of each basin and associated run-off curve numbers (CN), a weighted CN of 88 was derived for the combined Basin AB, and a weighted CN of 84 was determined for Basin C.

During the 10-year design storm event, drainage basin AB, had a peak run-off flow rate of 0.23 cubic feet per second (cfs), with a total volume of approximately 3,460 cubic feet (cf); drainage basin C has a peak run-off flow volume of 0.06 cfs, with a total volume of approximately 925 cf.

During the 100-year design storm event, drainage basin AB, had a peak run-off flow rate of 0.31 cfs, with a total volume of approximately 4,740 cf; drainage basin C has a peak run-off flow volume of 0.08 cfs, with a total volume of approximately 1,253 cf.

Retention Basin Modeling

Using the various surface areas of each basin (with Retention Basin AB having a bottom elevation of 442, and Retention Basin C having a bottom elevation of 443) and an infiltration rate of 6.8 inches per hour and a groundwater elevation of 440, the HydroCAD model indicted the following peak elevations in the two respective retention basins during the modeled 10- and 100-year, 24- hour storm events.

Table A

Post-Development Calculated Peak Stormwater Inflow Rates, Water Surface Elevations, and Storage Requirements

Basin	Storm Event	Post-Development			Preliminary Design Info	
		Peak Exfiltration Rate (cfs)	Peak W.S. Elevation (ft)	Storage Volume Required (cf)	Minimum Top Surface Elevation of Basin (ft)	Designed Storage Volume (cf) (to Elevation [ft])
Basin AB	10-year	0.11	442.56	270	444.1	1,874 (444)
	100-year	0.15	442.86	458	444.1	1,874 (444)
Basin C						
	10-year	0.03	443.94	89	445.1	436 (445)
	100-year	0.04	444.14	130	445.1	436 (445)

Conclusion

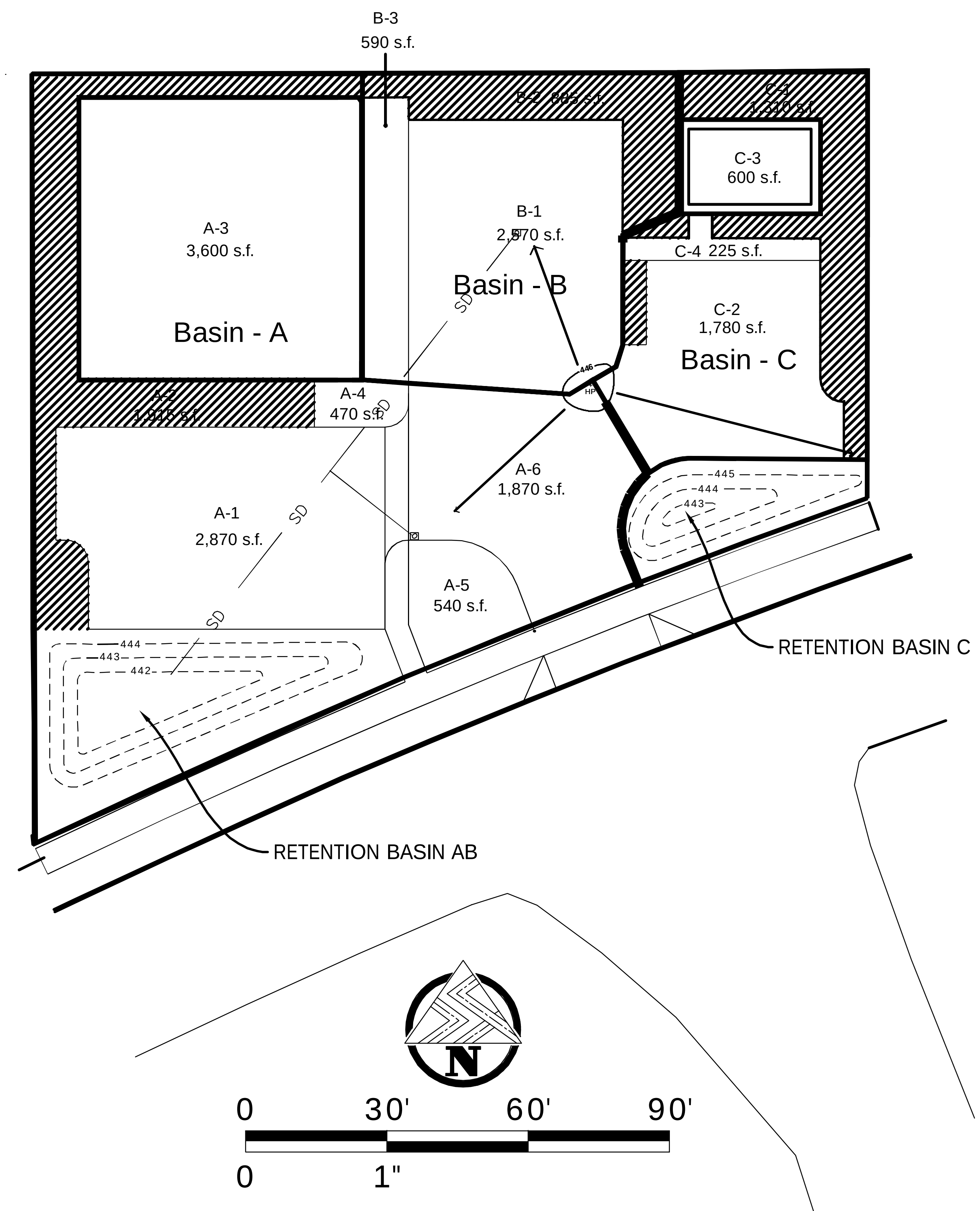
The stormwater management facilities with retention basins have been designed and sized to be in compliance with the City standards for stormwater management.

Drainage Basins A and B will drain into Retention Basin AB, which was modelled to have a peak water surface elevation of 442.56 during the 10-year, 24-hour design storm event, and a peak water surface elevation of 442.86 during the 100-year, 24-hour design storm event, maintaining freeboards of approximately 1.5 and 1.3 feet during the 10- and 100-year, 24-hour design storm events, respectively; no overflow from Retention Basin AB during the modeled 100-year, 24-hour design storm event is projected.

Drainage Basin C will drain into Retention Basin C, which was modelled to have a peak water surface elevation of 443.93 during the 10-year, 24-hour design storm event, and a peak water surface elevation of 444.11 during the 100-year, 24-hour design storm event, maintaining freeboards of approximately 1.2 and 1.0 feet during the 10- and 100-

year, 24-hour design storm events, respectively; no overflow from Retention Basin C during the modeled 100-year, 24-hour design storm event is projected.

APPENDIX A—DRAINAGE BASIN MAP



Basin - A	Surface Type	Area	CN - Value
A-1	Gravel	2,870	96
A-2	Landscape	1,915	39
A-3	Roof	3,600	98
A-4	Concrete	470	98
A-5	Landscape	540	39
A-6	Asphalt	1,870	98
RET. BASIN WET	Water	770	98
RET. BASIN LANDSCAPED	Landscape	1,290	39

Basin - B	Surface Type	Area	CN - Value
B-1	Asphalt	2,570	98
B-2	Landscape	885	39
B-3	Concrete	590	98

Basin - C	Surface Type	Area	CN - Value
C-1	Landscape	1,310	39
C-2	Asphalt	1,780	98
C-3	Roof	600	98
C-4	Concrete	225	98
RET. BASIN WET	Water	500	98
RET. BASIN LANDSCAPED	Landscape	455	39

PREPARED BY:

CIVIL ENGINEERS
LAND SURVEYORS
PROJECT MANAGERS
PLANNERS
www.pdgnw.com

REGISTERED PROFESSIONAL ENGINEER
15716PE
OREGON
JAN. 21, 1992
LEE NORTH BRENNAN
RENEWS: 12/31/2023

PRELIMINARY NOT FOR CONSTRUCTION

DATE SIGNED:

PREPARED FOR:

GFP Fire Staging Facility
1319 W. Washington Street
Stayton, Oregon

REVISIONS

NO.	DESCRIPTION	DATE	BY

PROJECT NO:	21021
HORIZ DATUM:	####
VERT DATUM:	####
HORIZ SCALE:	AS SHOWN
VERT SCALE:	AS SHOWN
DESIGN:	MF
DRAWN:	MF
CHECKED:	####

APPROVED:

SHEET TITLE

DRAINAGE BASIN MAP

EXHIBIT A

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APPENDIX B — GEOTECHNICAL, INFILTRATION, AND GROUNDWATER INFORMATION PROVIDED BY RAPID SOIL SOLUTIONS, INC.

GEOTECHNICAL REPORT w/ infiltration testing

1319 W Washington Street

Stayton, Oregon

For

EMS Inc

25 May 2021

Rapid Soil Solutions INC
3915 SW Plum Street
Portland, OR 97219
503-285-1636
mia@rapidsoilsolutions.com

INTRODUCTION

Rapid Soil Solutions Inc (RSS) has prepared this geotechnical report, as requested, for the proposed development of a 60' by 60' shop and 40' by 30' office within the Marion County parcel currently assigned the street address of 1319 W Washington Street in the City of Stayton, Oregon (97383). The subject site is situated on the northern side of W Washington Street roughly 160 feet northeast of its intersection with Miller Drive and 700 feet west-southwest of its intersection with N Gardner Ave. The eastern edge of the property abuts a Southern Pacific Railroad ROW, this rail line appears to terminate within the industrial property south of the subject site (Fruit & Vegetable Processing Industry; PNW Veg Co. LLC, 930 W Washington St). The site is positioned roughly 0.59 miles south of Shaff Road, 0.65 miles northwest of the North Santiam River, 0.65 miles west of N First Ave, and is 1.3 miles southwest of N Santiam Highway (OR-22). Adjacent properties include 1339 W Washington Street (west), 1329 Miller Drive (north), and 1243 Washington Street (east).

The subject site is comprised of a single Marion County parcel. The state tax lot identification number is 091W09DA01103. The Marion County account number is 136127. The abbreviated legal description of the site is P.P. 1998-004, PARCEL 2, ACRES 0.51. The site can be found in the northeast quarter of the southeast quarter of Section 9, Township 9-South, Range 1-West (W.M.) in Marion County, and can be distinguished by the lot number 1103. The latitude and longitude of the site are 44.801041 and -122.807689 (44°48'03.8"N, 122°48'27.7"W). The site can be found in the southeast quarter of the Stayton 7.5-minute quadrangle (SE ¼ of the Stayton 15' Quad).

SITE CONDITIONS

Surface Conditions

The subject site is comprised of a single tax parcel in Marion County, on slopes overlooking the North Fork Santiam River. The property is roughly the shape of a right trapezoid, where the southern property line follows the angle of the adjacent roadway. The site is about 177 feet wide and has a depth decreasing from east (164') to west (90'). The southwestern corner of the city is zoned for industrial application, the site is zoned light industrial and is situated along the northeastern edge of the district. Northeast of the subject site the zoning transitions to commercial and residential land uses. Local land use appears to be consistent with the zoning.

The subject site is situated within the Santiam River valley overlooking the west-flowing North Fork Santiam River. East of the subject site the valley is called Santiam Canyon, as it flows through volcanic deposits forming steep valley walls. Locally the valley opens up to a modernly broad plane with multiple terraces comprised of older sands and gravels. Deposits in the valley west of the subject site indicate that the North Fork Santiam River has meandered intermittently from its modern course to flow through Turner Gap. The local topography is relatively muted.

In front of the subject site, W Washington Street is a two-lane paved roadway. The roadway is relatively wide with concrete curbs on both sides. There is a grade crossing just beyond the southeastern corner of the site. There are no sidewalks along the local stretch of roadway.

General Site Conditions

The subject site is vacant and undeveloped parcel in the southwestern quarter of the City of Stayton, Oregon. The site is nearly level and contains a periodically mowed grass field. A small cluster of trees can be found in the southern margin of the site. A line of evergreen trees forms a hedge along the northern margins of the site, a chain link fence is also present at the northern edge of the site. A portion of the western property margin also contain s hedge.

The eastern margin of the site is bound by a rail line; it appears that a wire fence once separated the site form the RR ROW, but the fence is partially collapsed. To the north of the subject site is a property containing a small warehouse and a manufactured dwelling structure; the site contains numerous vehicles and semi-trailers. The property west of the subject site appears to contain a single-family dwelling structure and two auxiliary buildings/shops.

Figure 1: Existing conditions at the subject site. Aerial imagery from 2019 (Marion County Assessor's Office online map).

Historic Site Conditions

Historic aerial imagery dating back to 1954 was referenced as part of this investigation.

Early imagery of the subject site indicates that the property was part of a rural region, where the primarily land used was for agricultural applications. Most of the surrounding slopes contain large fields in the early imagery; an orchard appears to have once been present east of the subject site. W Washington Street is visible in the image from 1954.

A structure, likely a dwelling structure, is visible near the center of the subject site in images collected from 1954 through 1967.

The rail line east of the subject site appears to have been constructed between 1956 and 1967.

Between 1967 and 1982, the structure on the subject site appears to have been removed.

The site remains a vacant field in all of the images collected after 1982.

Slopes

The subject site is situated within the alluvial filled valley floor, adjacent to the North Fork Santiam River. The site is roughly 0.7 miles north-northwest of the river and about 18 feet higher in elevation. The slopes within the subject site are very low. The slopes across the local region are very low.

Lidar imagery suggests that the subject site is situated just above a minor riser separating the modern alluvial floodplain from an adjacent terrace. The local segment of W Washington Street appears to traverse this minor slope between terrace benches. This riser meets up with the modern river directly south of the intersection between W Ida Street and N Myrtle Ave. The Salem Ditch passes between the subject site and the North Fork Santiam River.

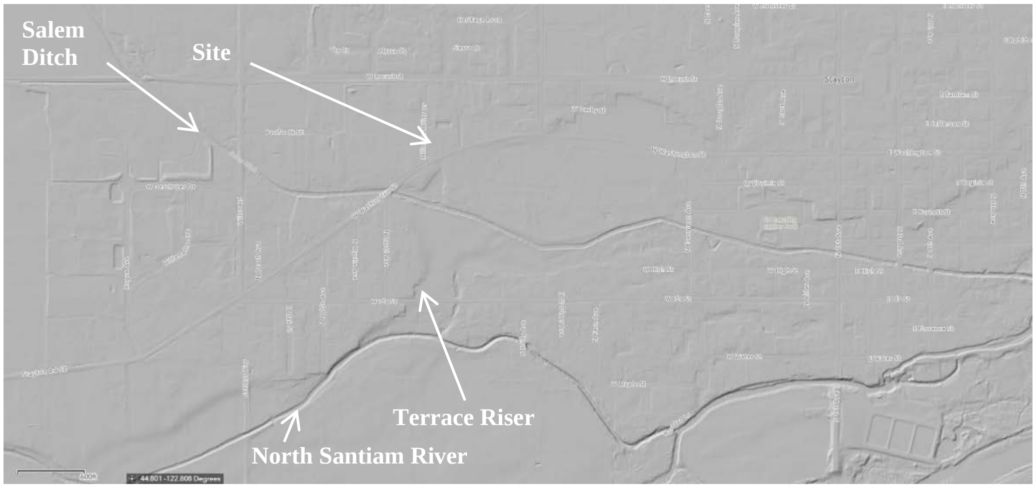
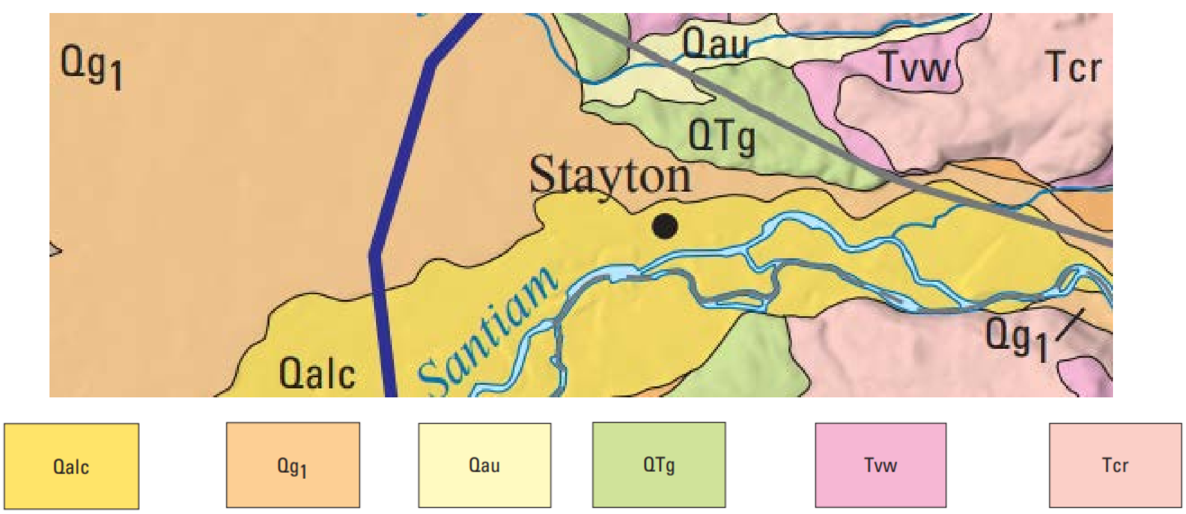


Figure 2: Hillshade of the Lidar imagery of the subject site and surrounding slopes.

Geology

Current geologic literature classifies the slopes underlying the subject site as relatively young alluvium, transported and deposited by the North Santiam River. This river has carved a canyon into early and late High Cascades Volcanic Rocks and basalt of the Columbia River Basalt Group; locally the bedrock deposits, below the quaternary materials, appear to be part of the Columbia River Basalt Group. The sedimentary materials filling the North Santiam River valley include sand and gravel deposits both predating and post-dating the Missoula Floods, as well as more recently emplaced floodplain deposits. O’Connor et al (2001) suggest that the subject site is located at the transition between recently deposited floodplain silts, sands and gravels (south) and slightly older sands and gravels emplaced after the Missoula Floods (upper Pleistocene).



Floodplain deposits of | Sand and Gravel | Alluvium, | Weathered | Volcanic & volcaniclastic | Columbia River

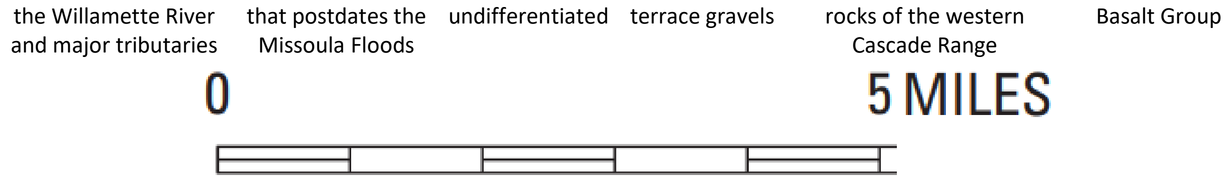


Figure 3: Geology at the subject site, except from O'Connor et al (2001).

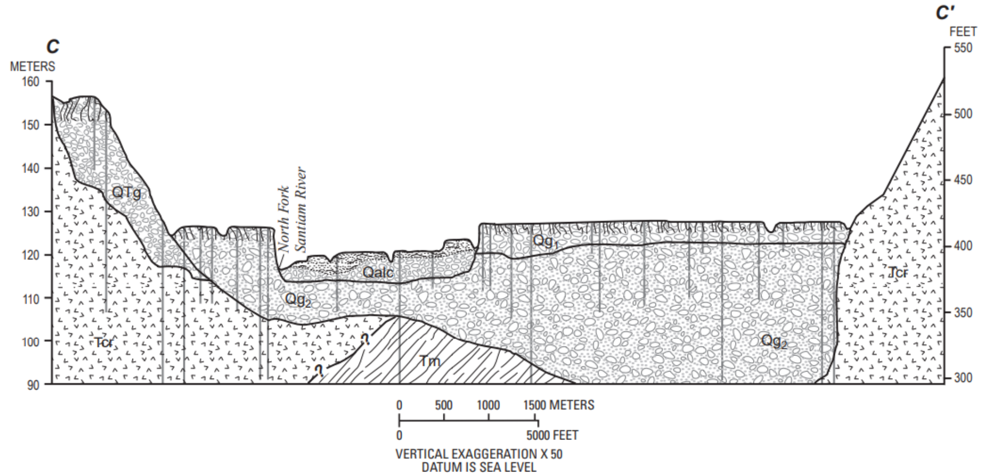


Figure 4: Subsurface geology on basis of stratigraphic exposures and drillers' logs, cross sections west of Stayton. Figure excerpt from O'Connor et al (2001). Valley fill includes sand and gravel that pre-dates (Qg2) and post-dates (Qg1) the Missoula Floods as well as weathered terrace gravels (QTg) and floodplain deposits of the North Fork Santiam River (Qafc).

Geologic History

The subject site is situated on the western flank of the Cascade Range mountains in Oregon. These uplands form the central part of a volcanic mountain range than extends from the northern end of the Sierra Nevada mountains in California to Mount Baker, a few miles south of the Canadian border. In Oregon the Cascade Range contains two physiographic regions: (1) the Western Cascade Range to the west and (1) the High Cascade Range to the east. The Western Cascade Range includes a wide, deeply dissected belt of volcanic deposits. The High Cascade Range is comprised of younger cones and lavas, which form a nearly undissected crest to the mountain range.

Locally, the Western Cascade Range is about 50 miles wide, with elevations of 4500 to 5000 feet and relief between 3000 and 4000 feet. Structurally the local uplands are comprised of volcanic deposits, comprised primarily of andesitic flows and tuffs, which filled a broad northward-trending downward. These deposits were subsequently folded into gentle northeast trending synclines and anticlines. Morphologically the Western Cascade Range typically contains narrow stream valleys separated by long acute ridges.

The eastern end of the Western Cascade Range is buried below the deposits of the High Cascade Range, generally found east of the subject site. The High Cascade Range contains average elevations of 5,000 to 7,000 feet, but reaches elevations of 8,000 feet.

The subject site is situated within an alluvial filled valley of the Western Cascade Range. Gravel, sand, and silt ranging in age from the Pleistocene to recently deposits can be found along the banks of modern streams across the Western Cascade Range. Locally, these deposits form at least one set of terraces adjacent to the Santiam River. Terraces are a stepped landform representing a former position of the floodplain/stream; they are three dimensional, morphological structures consisting of a tread and riser. The tread of each terrace forms a level to gently sloping, laterally extensive surface that forms the top of the terrace, flood-plain step, or similar stepped landform. The riser is a comparatively short escarpment forming the more steeply sloping edge between treads or adjacent to the channel. Terraces form along the flanks of stream valleys, parallel to the stream channel. The materials underlaying the local terrace were emplaced when the stream was at a higher level; as the stream incised into its historic floodplain, the local riser was carved into the previously deposited alluvium. These terraces represent remnant of depositional/erosional environments of the ancestral stream (i.e., abandoned floodplains, stream beds, or valley floors). Streams can contain multiple terraces representing multiple stream stages.

Site Geology

The deposits underlaying the subject site are comprised of alluvium, which locally forms a terrace along the northern margin of the Santiam River valley. Alluvium can include deposits of a wide range of grain sizes, influenced by the fluvial environment in which they were emplaced. Floodplains often contain thick accumulations of fine-grained sediments with occasional accumulations of peat. Deposits emplaced by more turbulent waters typically contain larger grains. Peak et al notes that most of the terrace deposits in the Western Cascades are comprised of unconsidered or poorly consolidated fluvial sediments. These include gravels ranging from pebbles to boulders, which are made up of Tertiary and Quaternary volcanic rocks. Higher elevation terraces contain more heavily weathered sediments, some of which have weathered to saprolite.

The North Santiam River is described as a flat-floored and steep-walled valley west of Gates. The valley bottom averages a mile to a mile and a half in width between Stayton and Gates, narrowing where it crosses lavas. The floor is veneered with gravel and typically contains several terraces ranging in height from 5 to 25 feet. The majority of the valley fill contains morphology suggestive of braidplains and multiple, shallow-channels, suggesting the materials were emplaced during periods of channel instability, high sediment supply, and a sediment load consisting primarily of bedload. Deposition was likely driven by high rates of sand and gravel producing wide and shallow channels with constantly migrating point bars and islands. I has also been noted that the ages of sand and gravel deposition are broadly consistent with times of glacial advances.

The major valley fills, as mapped by O'Connor et al (2001), are described as a "varied thicknesses of unconsolidated clay, silt, sand, and gravel derived from the Coast and Cascade Ranges. The upper 5 to 50 meters of these deposits is typically Quaternary-age gravel and sand deposited in thin, widespread sheets." O'Connor et al (2001) separates the Pleistocene sand and gravel into materials emplaced before and after the Missoula Floods. Unit Qg2 predates the catastrophic floods and constitutes the majority of the subsurface sand and gravel while Qg1 is a comparatively thin unit found capping numerous terraces. Within the Cascade Range tributary valleys, such as the North Fork Santiam River valley, these sands and gravels commonly display multiple terrace treads, separated by risers up to 5 m high. O'Connor et al (2001) notes that "Surface exposures of unit Qg1 typically show 1 to 2 m of massive silt overlying bedded sandy gravel."

Recent deposits (Qalc) have formed channels and floodplains of sand, silt, and gravel within lowlands and valleys. These deposits contain loose, openwork, imbricated gravel fining up to top strata of sand, silt, and clay. High deposits, and those as those found on the proximal edges of the valleys/floodplains, contain primarily overbank material of fine sand, silt, and clay (unconsolidated to loose). It is noted that these floodplain deposits vary greatly across their mapped extent.

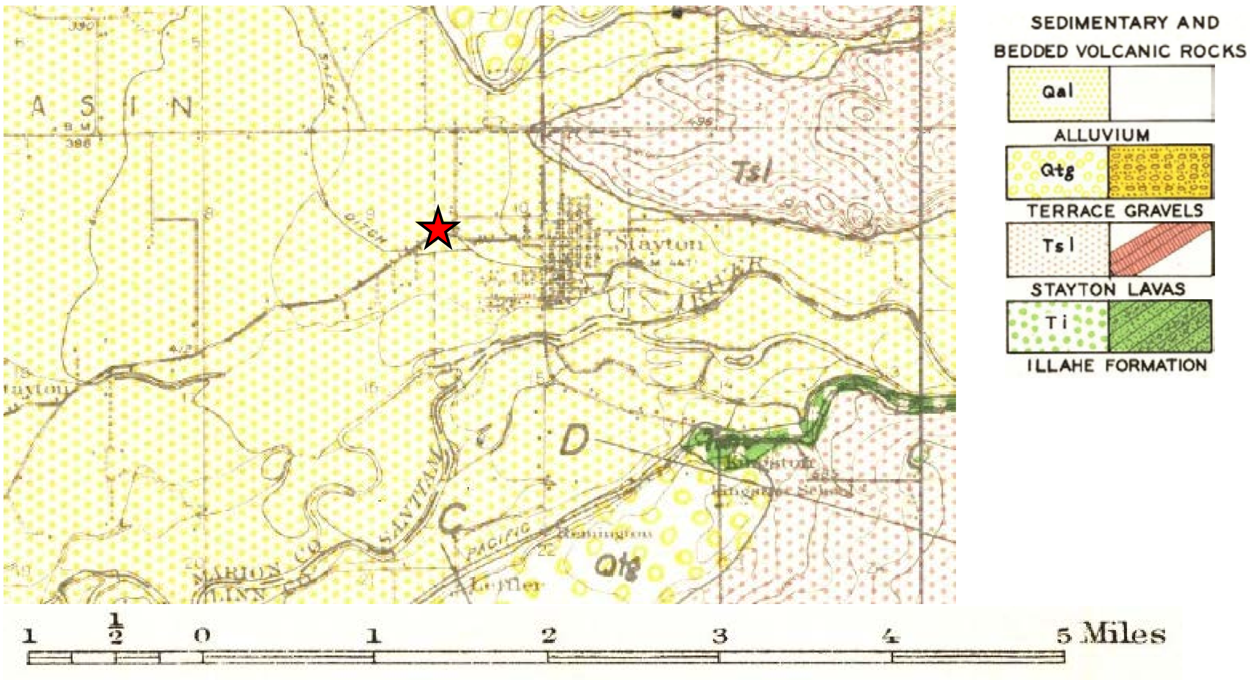


Figure 5: Geology at the subject site, excerpt from Thayer et al (1939).

Field Exploration

There is no sign of significant slope in the immediate vicinity of the proposed new structures that would be of concern for the stability of the structure. RSS observed less than 5 percent slopes on site. The site is enveloped with low grass and few trees along its southern margin. Pile of rocks was observed near the northwest corner of parcel. Neighboring parcels to the north and west are fenced. The parcel abuts a railroad track to its east.

A total of five (5) borings were excavated on site with a hand auger. The locations of the bore holes are shown on figure 3 in the appendix. An EIT, engineer-in-training, observed the excavation of the borings and logged the subsurface materials. A registered professional engineer reviewed the results. Boring logs detailing materials encountered is in the appendix. The logs were created using the Unified Soil Classification and Visual Manual Procedure (ASTM-D 2488).

The soils classification found on site were loose, medium stiff, silty-gravelly sand that stayed relatively the same up to the boring depths of 2 feet and 3 feet prior to refusal. Refusal was encountered on HA-1, HA-3, HA-4 and HA-5 due to abundant rounded and subangular river rocks on site. Infiltration tests were conducted on HA-4 and HA-5 at a depth of 3 ft.

Moisture contents ranged from 18.3% to 21.6%. No groundwater was encountered.

The soils on the subject site, as mapped by the USDA National Resource Conservation Service Web Soil, are classified as Sifton gravelly loam. These soils form on terraces from alluvium of gravelly sand. The soils are classified as well drained with a water table found at depths exceeding 80 inches. The typical profile is comprised of gravelly loam (H1: 0"-17", H2: 17"-24") and extremely gravelly coarse sand (H3: 24"-60").

Geohazard Document Review

The Oregon HazVu: Statewide Geohazard Viewer and Metro Map were reviewed on 20 May 2021 to investigated mapped geological hazards.

This review indicates that the subject site is outside the 100-year floodplain, as mapped by FEMA.

The expected earthquake-shaking hazard is classified as ‘very strong’ with no mapped earthquake liquefaction hazard.

The local morphology suggests that the low slopes within and surrounding the subject site are not particularly susceptible to landslides. The site is mapped as having a low landslide hazard. No landslides are mapped on or adjacent to the subject site. No distinct landslide morphology was observed in the lidar imagery of the subject site.

Excavations

Excavations can be accomplished with conventional excavating equipment. All excavations for footings and subgrades in the fine-grained silt should be performed by an excavator or backhoe equipped with a smooth-faced bucket (no teeth) and with a bucket that has teeth.

Because of safety considerations and the nature of temporary excavations, the Contractor should be made responsible for maintaining safe temporary cut slopes and supports for utility trenches, etc. We recommend that the Contractor incorporate all pertinent safety codes during construction, including the latest OSHA revised excavation requirements, and based on soil conditions and groundwater evidenced in cuts made during construction.

Structural Fills

Depending upon finished building pad elevations, structural fills may be required to raise the site grades. Additionally, fill may be required for the backfilling of the proposed new foundation walls. Native or imported material may be used for fill, provided the soil is free of organics, cobbles larger than 6 inches in maximum diameter, or other deleterious matter; is of low plasticity; and, is at the proper water content. Fills should be placed on level benches in thin lifts and compacted to a dry density of at least 92% of its Maximum Dry Density (MDD) as determined by the Modified Proctor Test (ASTM D-1557), if using rock and 95% of Standard proctor test (ASTM D-698) if using soil.

For any over-excavation completed in the area of footings or slabs, the backfill material shall consist of free-draining, well-graded, crushed aggregate base with a maximum particle size of ¾ inch. The rock shall not contain more than 5% fines (material passing the No. 200 sieve, as tested by ASTM D-1140). The rock shall be compacted to a dry density of at least 92% of its MDD.

Foundation Design

Based on the field exploration and our experience with this soil formation it is our opinion that the foundation should consist of conventional spread footings. Footing excavations should be evaluated by the Engineer to confirm suitable bearing conditions. All concrete footings should be founded at least 1.0 feet below the lowest exterior grade, and 16 inches below the finished floor elevation, whichever is deeper. Interior footings may also be founded at a depth of 16 inches below the finished floor elevation. ***RSS should be given at least 48hours notice to come and inspection foundation excavation.***

The new footings should be designed for a maximum allowable bearing pressure of 2,000 pounds per square foot (psf) as per scribed in 2018 IBC code book under section 1804.2 Table 2 Allowable Foundation and Lateral Pressures. When sizing footings for seismic considerations, the allowable bearing pressure may be increased by 1/3. Lateral pressures may be resisted by friction between the bases of the footings and the underlying ground surface.

Engineering values summary

Bearing capacity of native soils	2,000psf
Coefficient of friction native soils	0.35
Active pressure	40pcf
Passive pressure	300pcf

Note: factors of safety of 1.5 has been applied to the above values

Settlement

Based on our knowledge of the project scope, and for footings designed as described in the preceding paragraphs, maximum settlement should not exceed 1 inch. Differential settlement should be on the order of 50 to 75% of the maximum settlement over 50 feet. Our settlement estimate assumes that no disturbance to the foundation soils would be permitted during excavation and construction, and that footings are prepared as described in the preceding paragraphs.

Seismic Design Criteria

The seismic design criteria for this project found herein is based on the IBC 2018 A summary of IBC seismic design criterion is below it is generated from the USGS web site for earthquake hazards using a latitude of 45.801041 and a Long of -122.807689, D site class,
null= see section 11.4.8

	Short Period	1 Second
Maximum Credible Earthquake Spectral Acceleration	Ss = 0.836	S1 = 0.4
Adjusted Spectral Acceleration	Sms = 1.003	Sm1 = null
Design Spectral Response Acceleration Perimeters	Sds = 0.669	Sd1= null

Pavement Cross Section

Given the future parking traffic and vendors with trucks to the site RSS recommends the pavement section consist of 6" of 1 ½" minus with 2" of ¾" minus on top. RSS will need to proof rolls the excavated roadway with a loaded dump truck to ensure the driveway is hard and non-yielding. ***Please give 48 hours' notice when proof rolling by phone call.***

Infiltration testing

RSS conducted two (2) infiltration tests in the proposed storm water areas. The tests were conducted using the EPA falling head method in a hand augur hole with a pipe inserted into the hole. See the infiltration sheet with soils details in the appendix. At HA#4 the rate was 13.75in/hr. and at HA#5 27in/hr.

Drainage

The Contractor should be made responsible for temporary drainage of surface water and groundwater as necessary to prevent standing water and/or erosion at the working surface. The ground surface around the structure should be sloped to create a minimum gradient of 2% away from the building foundations for a distance of at least 5 feet. Surface water should be directed away from all buildings into drainage swales or into a storm drainage system. "Trapped" planting areas should not be created next to any buildings without providing means for drainage.

Limitations

This report has been prepared for the exclusive use of the addressee, and their architects and engineers for aiding in the design and construction of the proposed development. It is the addressee's responsibility to provide this report to the appropriate design professionals, building officials and contractors to ensure correct implementation of the recommendations.

The opinions, comments and conclusions presented in this report were based upon information derived from our literature review, field investigation and laboratory testing. Conditions between, or beyond, my exploratory test pits may vary from those encountered. Unanticipated soil conditions and seasonal soil moisture variations are commonly encountered and cannot be fully determined by merely taking soil samples. Such variations may result in changes to our recommendations and may require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

References

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Google Earth 2020

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Marion County Assessor's Office: https://www.co.marion.or.us/AO/Pages/default.aspx

City of Stayton interactive map http://www.staytonoregon.gov/page/docs_interactive_city_map

USGS Topo View: https://ngmdb.usgs.gov/topoview/

DOGAMI Oregon State Wide Geohazard Viewer (HazVu): https://gis.dogami.oregon.gov/maps/hazvu/

DOGAMI Lidar Viewer: https://gis.dogami.oregon.gov/maps/lidarviewer/

DOGMAI Statewide Landslide Information Layer for Oregon: https://gis.dogami.oregon.gov/maps/slido/

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Appendix

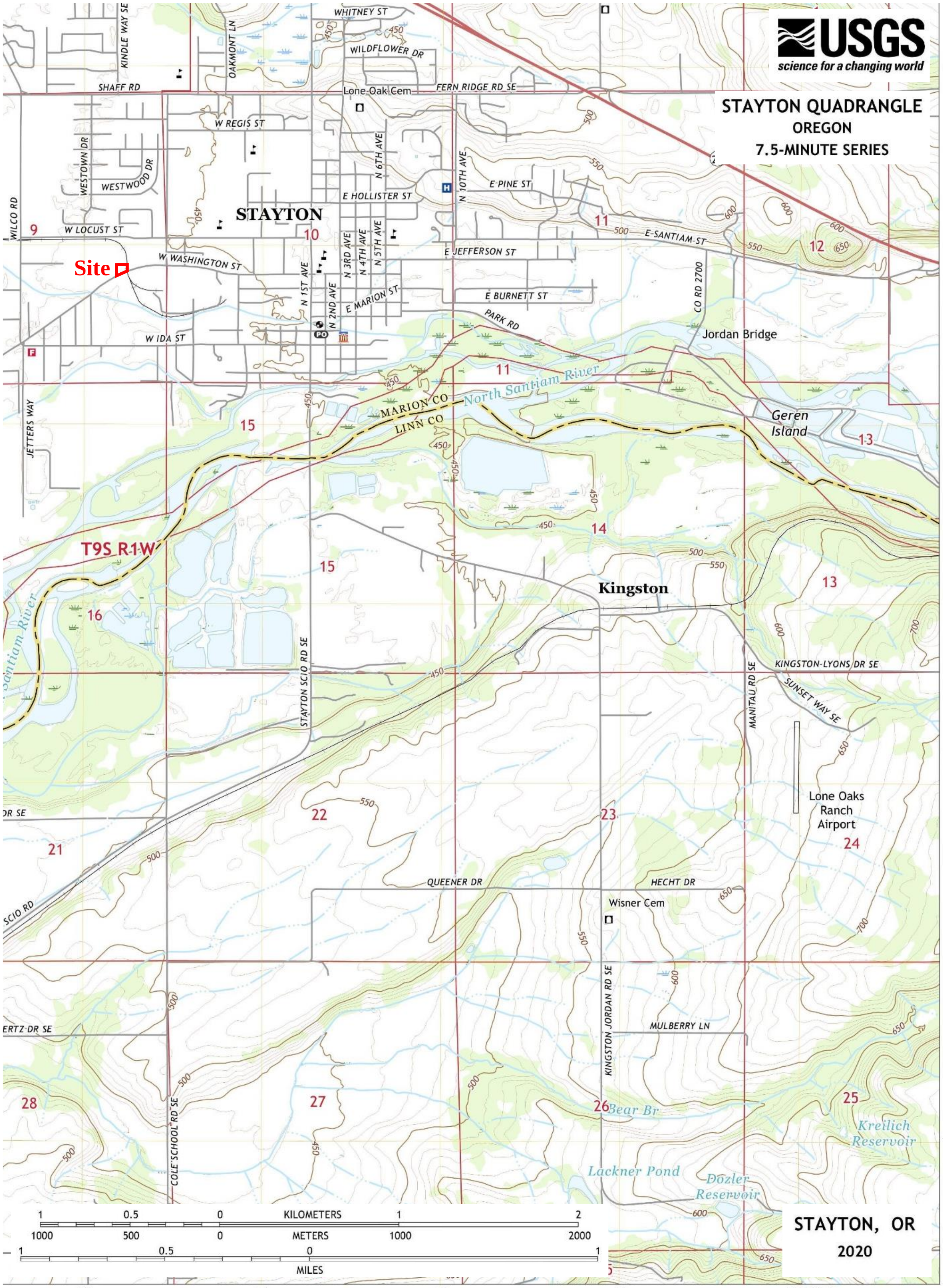


Figure 1: Subject site location on the SE ¼ of the Stayton 7.5-minute quadrangle

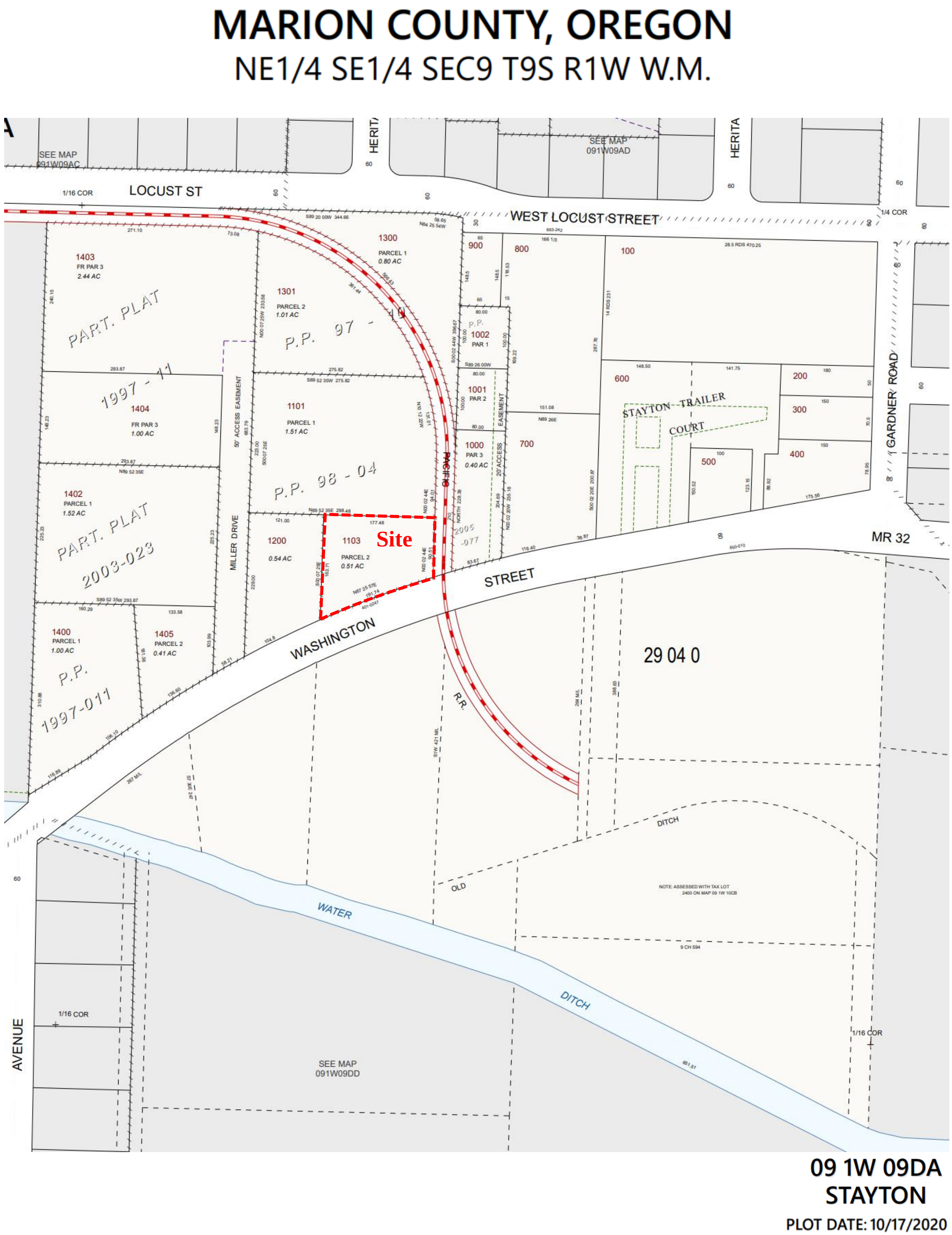


Figure 2: Subject site location on the Marion County Assessor's Map

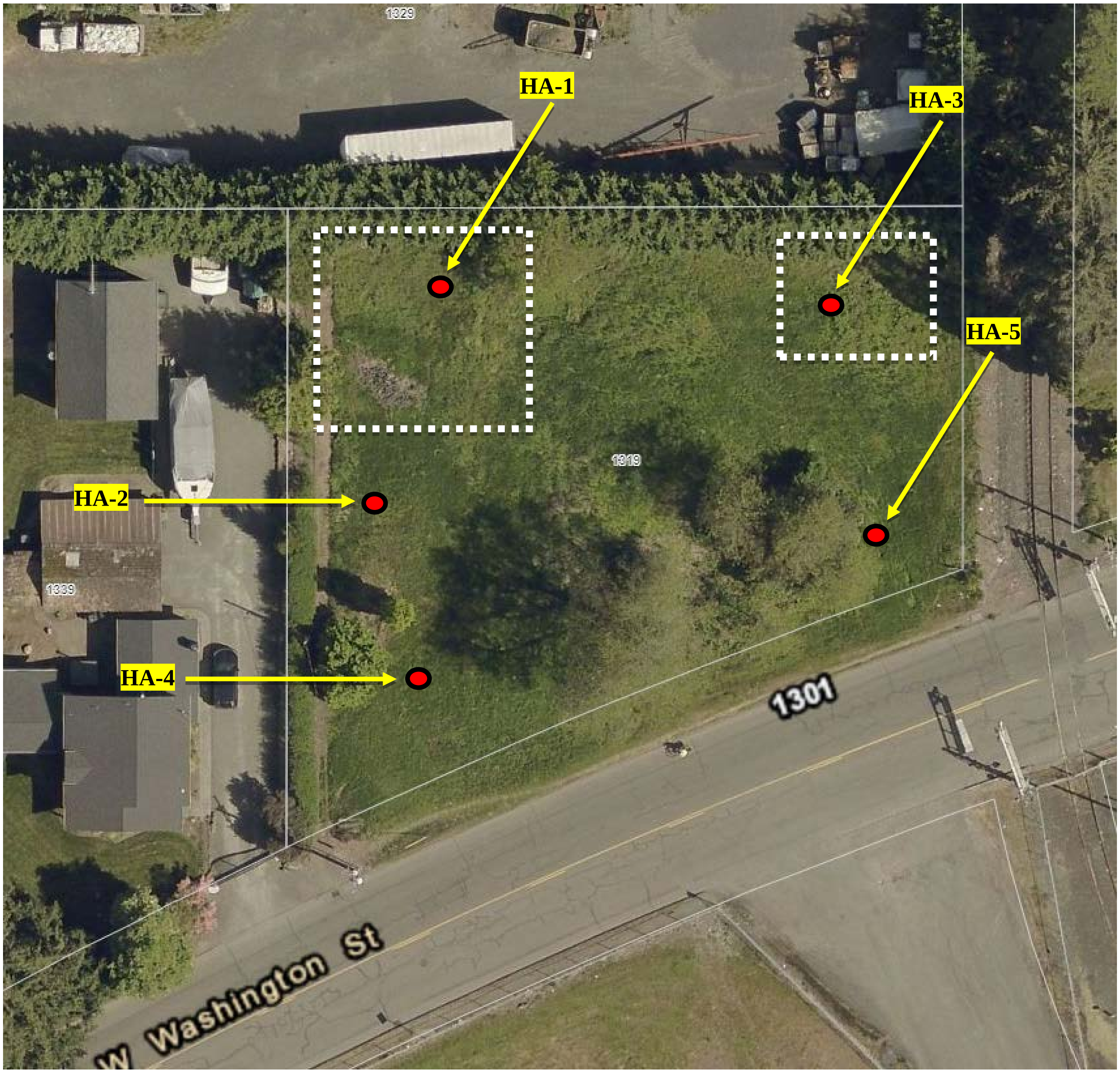
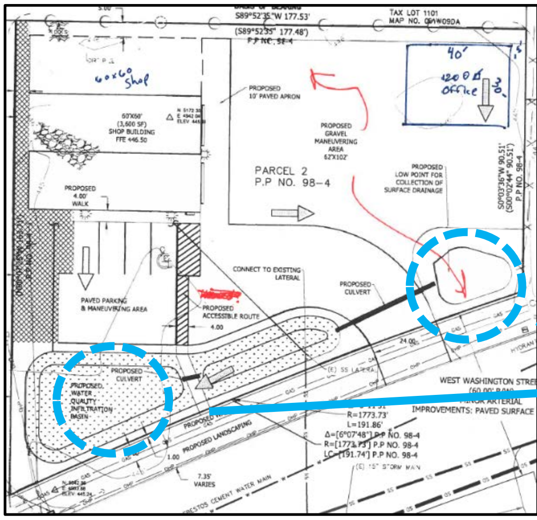


Figure 3: Testing Locations

Rapid Soil Solutions Infiltration Test Results



Preliminary Information			
Location:	1319 W Washington St. Stayton, OR (97383)	**Performed By: (Supervised by Mia Mahedy, PE, GE)**	Grace Atijera, EIT
Date & Time:	12 May 2021, 9:00 AM	**Instrument Used:**	Hand Auger
Weather:	Clear, 60 degrees	**Depth:**	3 feet

Soil Profile Detail: HA-5

Depth (ft)	Description
0 – 3.0	Barely damp, dark to medium brown, fine to medium grained, abundant river rocks (round and subangular), medium stiff, silty GRAVELS, REFUSAL

Time	Measurement (inches)	Level Refilled To (inches)	Rate (inches/hour)
9:30	12.0	-	
9:40	2.0	-	
9:48	0	12.0	40.0
9:58	3.75	-	
10:08	0	13.5	36.0
10:18	5.5	-	
10:28	2.5	-	
10:38	0	-	27.0
Site Infiltration Rate (inches/hour)			**27.0**

Rapid Soil Solutions INC | 503-816-3689 | mia@rapidsoilsolutions.com

Soil Profile Detail: HA-4			
Depth (ft)	**Description**		
0 – 3.0	Barely damp, dark to medium brown, fine to medium grained, abundant river rocks (round and subangular), medium stiff, silty GRAVELS, REFUSAL		
Time	**Measurement (inches)**	**Level Refilled To (inches)**	**Rate (inches/hour)**
9:50	13.0	-	
10:10	5.0	-	
10:30	0.5	-	
10:35	0	13.25	17.33
10:55	6.5	-	
11:15	1.5	-	
11:30	0	13.75	14.45
11:50	6.75	-	
12:10	2.0	-	
12:30	0	-	13.75
Site Infiltration Rate (inches/hour)			**13.75**

Lab Results

Project Name: 1319 W Washington St., Stayton — Sample Date 5/12/2021

Moisture

	Sample number	HA#1	HA#2	HA#3	HA#4	HA#5
1	Date and time in oven	5/13/2021 - 1:10PM	5/13/2021 - 1:10PM	5/13/2021 - 1:10PM	5/13/2021 - 1:10PM	5/13/2021 - 1:10PM
2	Date and time out of oven	5/14/2021 - 7:15AM	5/14/2021 - 7:15AM	5/14/2021 - 7:15AM	5/14/2021 - 7:15AM	5/14/2021 - 7:15AM
3	Depth (ft)	2	2	2	3	3
4	Tare No.	1	2	3	4	5
5	Tare Mass	234	234	233	231	234
6	Tare plus sample moist	789	817	742	868	785
7	Tare plus sample dry	703	720	658	755	699
8	Mass of water (g)	86	97	84	113	86
9	Mass of soil (g)	469	486	425	524	465
10	Water Content (%)	18.3	20.0	19.8	21.6	18.5

Grain Size Analysis: Dry Sieve Method

Sample Number: HA#1

Total Sample Weight (g): 471.00

Sieve #	Weight (g)	% Retained	
>1/4"	197.00	41.83	Gravels and Larger
1/4" to #40	226.00	47.98	Medium-Coarse Sand
#40 to #200	46.00	9.77	Fine Sand
< #200	2.00	0.42	Fines (Silt & Clay)
> #200	471.00	100.00	**Classification: SP-SM**

Sample Number: HA#3

Total Sample Weight (g): 429.00

Sieve #	Weight (g)	% Retained	
>1/4"	150.00	34.97	Gravels and Larger
1/4" to #40	264.00	61.54	Medium-Coarse Sand
#40 to #200	13.00	3.03	Fine Sand
< #200	2.00	0.47	Fines (Silt & Clay)
> #200	429.00	100.00	**Classification: SP-SM**

Sample Number: HA#5

Total Sample Weight (g): 464.00

Sieve #	Weight (g)	% Retained	
>1/4"	178.00	38.36	Gravels and Larger
1/4" to #40	220.00	47.41	Medium-Coarse Sand
#40 to #200	63.00	13.58	Fine Sand
< #200	3.00	0.65	Fines (Silt & Clay)
> #200	464.00	100.00	**Classification: SP-SM**

Rapid Soil Solutions INC

HA-1

Surface Elevation:
Boring Date: 12 April 2021
Boring Location: Stayton, W A
Drilling Method: Hand Auger

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		Description
0						GWT not encountered	TP	Top Soil w/ grass roots and gravels
							SP-SM	Dry, very dark brown, fine to coarse grained, abundant river rocks (rounded and subangular), loose, medium stiff, silty-gravelly SAND
1								
2	41.83% > 1/4", 47.98% retained #4 sieve	18.3						Boring completed at depth of 2ft, Refusal
3								
4								
5								
6								
7								

LOG OF BORING

Rapid Soil Solutions	**1319 W Washington St.**	**Plate 1**

HA-2

Surface Elevation:
Boring Date: 12 April 2021
Boring Location: Stayton, W A
Drilling Method: Hand Auger

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table	USCS	Description
0						GWT not encountered	TP	Top Soil w/ grass roots and gravels
							SP-SM	Dry, very dark brown, fine to coarse grained, abundant river rocks (rounded and subangular), loose, medium stiff, silty-gravelly SAND
1								
2		20.0						Boring completed at depth of 2ft
3								
4								
5								
6								
7								

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Users\Chelsea\Desktop\Grace 2021\Geotech Reports\Stayton, OR\1319 W Washington St\HAs - 1319 W Washington St.log Date: 5/14/2021

LOG OF BORING

Rapid Soil Solutions	**1319 W Washington St.**	**Plate 2**

HA-3

Surface Elevation:
Boring Date: 12 April 2021
Boring Location: Stayton, W A
Drilling Method: Hand Auger

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		Description
0						GWT not encountered	TP	Top Soil w/ grass roots and gravels
							SP-SM	Dry, very dark brown, fine to coarse grained, abundant river rocks (rounded and subangular), loose, medium stiff, silty-gravelly SAND
1								
2	34.97% > 1/4", 61.54% retained #4 sieve	19.8						Boring completed at depth of 2ft, Refusal
3								
4								
5								
6								
7								

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Users\Chelsea\Desktop\Grace 2021\Geotech Reports\Stayton, OR\1319 W Washington St\HAs - 1319 W Washington St.log Date: 5/14/2021

LOG OF BORING

Rapid Soil Solutions	**1319 W Washington St.**	**Plate 3**

HA-4

Surface Elevation:
Boring Date: 12 April 2021
Boring Location: Stayton, W A
Drilling Method: Hand Auger

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		Description
0						GWT notencountered	TP	Top Soil w/ grass roots and gravels
							SP-SM	Barely damp, very dark brown, fine to coarse grained, abundant river rocks (rounded and subangular), loose, medium stiff, silty-gravelly SAND
1								
2								
3		21.6						Boring completed at depth of 3ft, Refusal
4								
5								
6								
7								

LOG OF BORING

Rapid Soil Solutions	1319 W Washington St.	Plate 4

HA-5

Surface Elevation:
Boring Date: 12 April 2021
Boring Location: Stayton, W A
Drilling Method: Hand Auger

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table	USCS	Description
0						GWT not encountered	TP	Top Soil w/ grass roots and gravels
							SP-SM	Barely damp, very dark brown, fine to coarse grained, abundant river rocks (rounded and subangular), loose, medium stiff, silty-gravelly SAND
3	38.36% > 1/4", 47.41% retained #4 sieve	18.5						Boring completed at depth of 3ft, Refusal

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Users\Chelsea\Desktop\Grace 2021\Geotech Reports\Stayton, OR\1319 W Washington St\HAs - 1319 W Washington St.log Date: 5/14/2021

LOG OF BORING

Rapid Soil Solutions	**1319 W Washington St.**	**Plate 5**

Addendum for ground water at

1319 W Washington Street, Stayton

Rapid Soil Solutions (RSS) is using this addendum to address the subject of shallow ground water. Attached are two (2) well logs that are within a 1/2mile of the site and similar elevation. Water was found at 35ft and 40ft below grade.

Shallow ground water is not an issue for this site.

REGISTERED PROFESSIONAL
ENGINEER
19244PE
OREGON
JULY 15, 1997
MIA C. MAHEDY
EXPIRES: 12-31-2022

Mia Mahedy, PE GE

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

13574

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

(Do not write above this line)

RECEIVED JUN 6 1979 WATER RESOURCES DEPT. SALEM, OREGON

State Well No. 9S/1W-9

State Permit No. ....

(1) OWNER:

Name Joe Jakota

Address 1133 Gardner
Stayton, OR. 97383

(2) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED: Threaded ☐ Welded ☒

6" Diam. from +1 ft. to 37 ft. Gage .250
......" Diam. from ...... ft. to ...... ft. Gage ......
......" Diam. from ...... ft. to ...... ft. Gage ......

PERFORATIONS: Perforated? ☐ Yes ☒ No.

Type of perforator used

Size of perforations ...... in. by ...... in.

...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No

Manufacturer's Name

Type ...... Model No. ......

Diam. ...... Slot size ...... Set from ...... ft. to ...... ft.
Diam. ...... Slot size ...... Set from ...... ft. to ...... ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.

" " "
" " "

Bailer test 45 gal./min. with 5 ft. drawdown after 1 hrs.

Artesian flow g.p.m.

perature of water 54 Depth artesian flow encountered ...... ft.

(9) CONSTRUCTION:

Well seal—Material used Cement Grout

Well sealed from land surface to 22 ft.

Diameter of well bore to bottom of seal 10" in.

Diameter of well bore below seal 6" in.

Number of sacks of cement used in well seal 30 sacks

How was cement grout placed? Pumped thru Tremi pipe

Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? depth of strata

Method of sealing strata off

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ...... ft. to ...... ft.

(10) LOCATION OF WELL:

County Marion Driller's well number

¼ ¼ Section 9 T. 9S R. 1W W.M.

Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found 35 ft.

Static level 5 ft. below land surface. Date 5/3/79

Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing —

Depth drilled 39 ft. Depth of completed well 37 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
TopSoil, w/Gravels, Small to Large w/Cobbles	0	2	
Clay, brown w/Gravels, Cobbles + Small Boulders	2	15	
Gravels, w/Cobbles + Small Boulders	15	17	
Gravels, w/Cobbles + Small Boulders, brown Clay	17	19	
Sand, black, Clayey w Small Boulders	19	27	
Gravels, Cobbles, Small Boulders, Cemented	27	30	
Gravels, Small to Large Cobbles, Small Boulders, Clay	30	35	
Water drilled some around 31 feet.			
Gravels, Small to Very Large Cobbles + Small Boulders	35	37	5
Gravels, Cobbles, Small Boulders, w/brown Clay	37	39	

Work started 4/26 1979 Completed 5/3 1979

Date well drilling machine moved off of well 5/3 1979

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] S. R. McDonald (Drilling Machine Operator) Date 5/5, 1979

Drilling Machine Operator's License No. 986

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name AQUA-TECH Well Construction Inc. (Person, firm or corporation) (Type or print)

Address 868 Delta Dr. N.E.

[Signed] David Beach (Water Well Contractor)

Contractor's License No. ...... Date ......, 19......

(USE ADDITIONAL SHEETS IF NECESSARY)

696

SP*45656-119

MARI.... 13572

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

RECEIVED
MAY 18 1965
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 9/1w-9Q

State Permit No.

(1) OWNER:

Name Mike Adams

Address 510 W. Virginia St.
Stayton, Ore.

(2) LOCATION OF WELL:

County Marion Driller's well number 104

SW ¼ SE ¼ Section 9 T. 9S R. 1W W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☐ Test Well ☐ Other ☒ Shop

(5) TYPE OF WELL:

Rotary ☐ Driven ☐

Cable ☒ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒

6 " Diam. from 0 ft. to 40 ft. Gage .250

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☒ No

Type of perforator used

Size of perforations in. by in.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

(8) SCREENS: Well screen installed? ☐ Yes ☒ No

Manufacturer's Name

Type Model No.

Diam. Slot size Set from ft. to ft.

Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Well seal—Material used in seal Bentonite-cement

Depth of seal 25 ft. Was a packer used? no

Diameter of well bore to bottom of seal 9 in.

Were any loose strata cemented off? ☒ Yes ☐ No Depth 25

Was a drive shoe used? ☒ Yes ☐ No

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Polution depth of strata 1' to 20'

Method of sealing strata off Cement grout 25' to 20'

(10) WATER LEVELS:

Static level 15 ft. below land surface Date 5/8/65

Artesian pressure lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.

" " " "

" " " "

Bailer test 35 gal./min. with 6 ft. drawdown after 1 hrs.

Artesian flow g.p.m. Date

Temperature of water 53 Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG: Diameter of well below casing

Depth drilled 40 ft. Depth of completed well 40 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifiers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Top-soil	0'	2'
Cobbles-sand-gravel (loose)	2'	8'
Cement gravel	8'	13'
Silted gravel (soft)	13'	16'
Cement gravel	16'	32'
Loose sand-gravel	32'	33'
Med. sand (tight packed)	33'	35'
Red-brown clay & gravel	35'	36'
Cement gravel	36'	38'
River gravel	38'	40'

Work started 5/6/65 19 . Completed 6/8/65 19

Date well drilling machine moved off of well 5/8/65 19

(13) PUMP:

Manufacturer's Name

Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Pete Tolmasoff Well Drilling
(Person, firm or corporation) (Type or print)

Address Turner, Ore.

Drilling Machine Operator's License No. 320

[Signed] Peter J. Tolmasoff
(Water Well Contractor)

Contractor's License No. 410 Date 5/12/65 19

(USE ADDITIONAL SHEETS IF NECESSARY)

APPENDIX C — NRCS SOIL RESOURCE REPORT

United States Department of Agriculture

NRCS

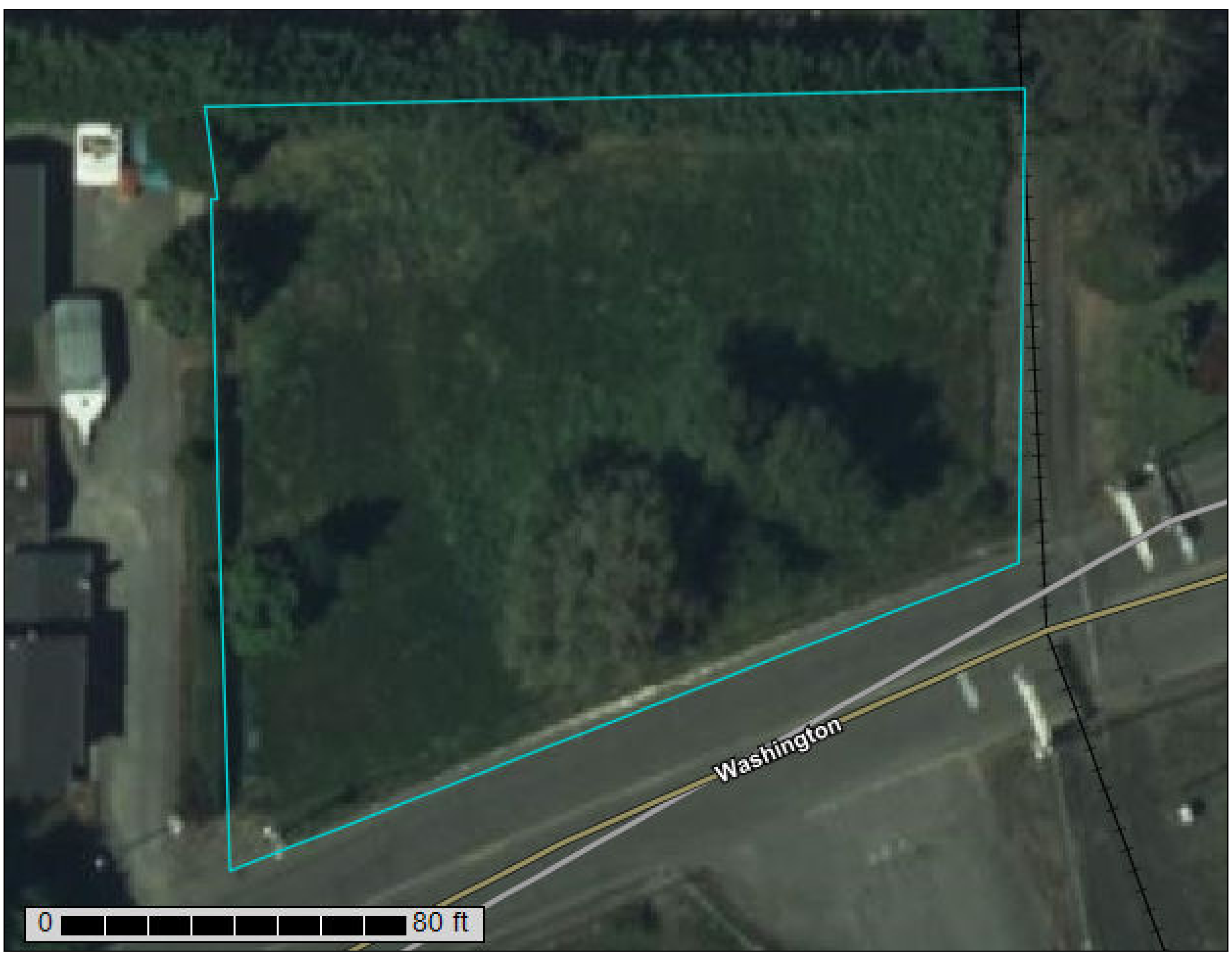
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Marion County Area, Oregon

GFP Fire Staging Facility



January 4, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:467 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 5, 10, 20, 30

Feet: 0, 20, 40, 80, 120

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Marion County Area, Oregon
Survey Area Data: Version 19, Oct 27, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 28, 2020—May 29, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
St	Sifton gravelly loam	0.6	100.0%
Totals for Area of Interest		**0.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Marion County Area, Oregon

St—Sifton gravelly loam

Map Unit Setting

National map unit symbol: 24rg
Elevation: 100 to 600 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 200 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sifton and similar soils: 92 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sifton

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium over gravelly sand

Typical profile

H1 - 0 to 17 inches: gravelly loam
H2 - 17 to 24 inches: gravelly loam
H3 - 24 to 60 inches: extremely gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Ecological site: R002XC006OR - Stream Terrace Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

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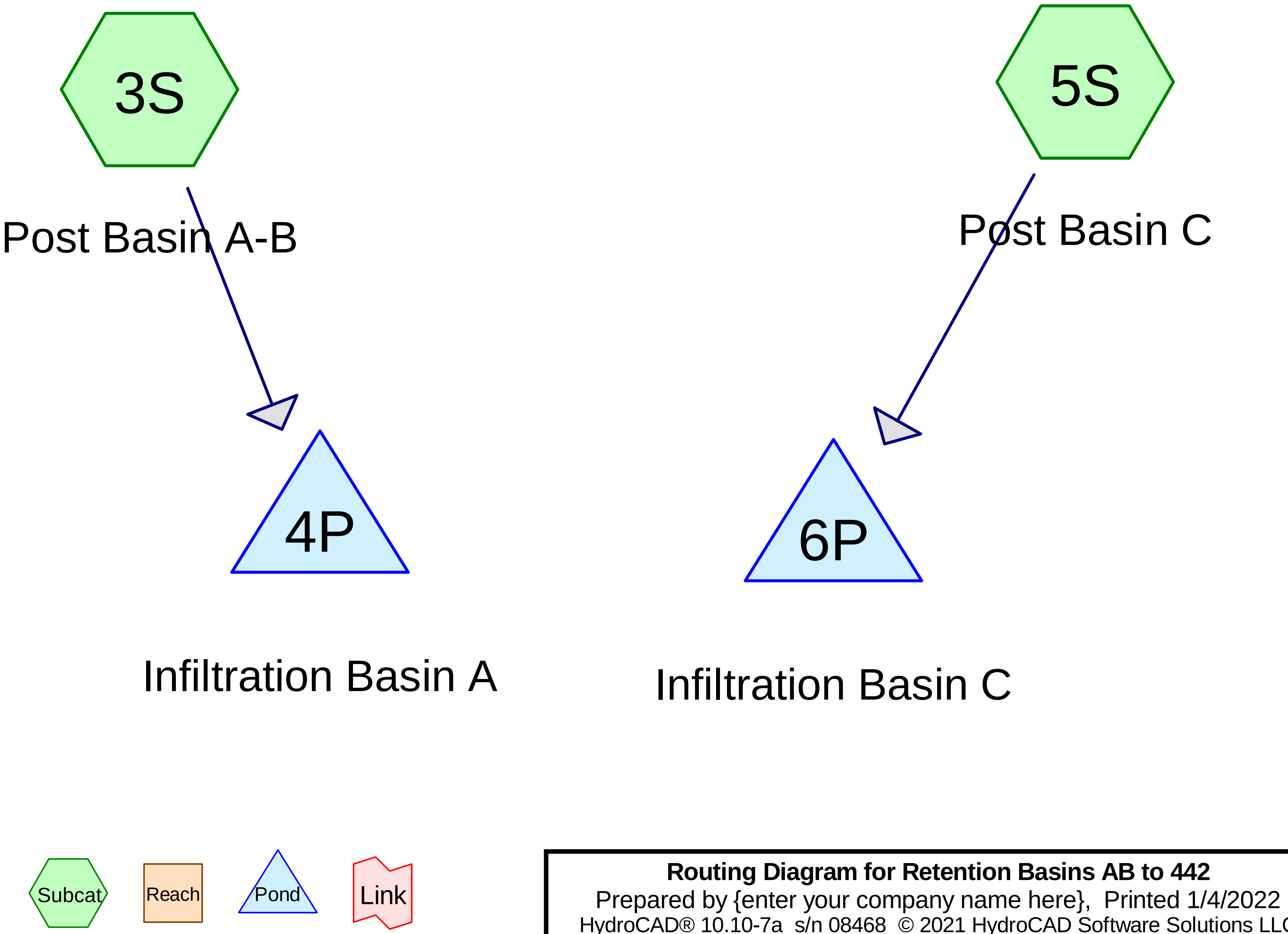
APPENDIX D — DESIGN CALCULATIONS/HYDROCAD MODEL SUMMARY RESULTS



Routing Diagram for Retention Basins AB to 442

Prepared by {enter your company name here}, Printed 1/4/2022

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-year	Type IA 24-hr		Default	24.00	1	3.50	2
2	100-year	Type IA 24-hr		Default	24.00	1	4.50	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
1,310	60	>75% Grass cover, Good, HSG B (5S)
770	98	Basin - Wet (up to Elev. 444) (3S)
1,290	60	Basin, landscape, grass, above Elev. 444 (3S)
2,870	96	Gravel surface, HSG B (3S)
455	60	Landscape basin above Elev 445 >75% grass cover HSG B (5S)
3,340	60	Landscape>75% Grass cover, Good, HSG B (3S)
7,505	98	Paved parking, walkways, HSG B (3S, 5S)
4,200	98	Roofs, HSG B (3S, 5S)
500	98	Wet Basin, Up to Elev 445 (5S)

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	1,310	0	0	0	1,310	>75% Grass cover, Good	5S
0	0	0	0	770	770	Basin - Wet (up to Elev. 444)	3S
0	0	0	0	1,290	1,290	Basin, landscape, grass, above Elev. 444	3S
0	2,870	0	0	0	2,870	Gravel surface	3S
0	455	0	0	0	455	Landscape basin above Elev 445 >75% grass cover	5S
0	3,340	0	0	0	3,340	Landscape>75% Grass cover, Good	3S
0	7,505	0	0	0	7,505	Paved parking, walkways	3S, 5S
0	4,200	0	0	0	4,200	Roofs	3S, 5S
0	0	0	0	500	500	Wet Basin, Up to Elev 445	5S

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 3S: Post Basin A-B Runoff Area=17,370 sf 56.82% Impervious Runoff Depth=2.39"
Tc=5.0 min CN=74/98 Runoff=0.23 cfs 3,462 cf

Subcatchment 5S: Post Basin C Runoff Area=4,870 sf 63.76% Impervious Runoff Depth=2.28"
Tc=5.0 min CN=60/98 Runoff=0.06 cfs 923 cf

Pond 4P: Infiltration Basin A Peak Elev=442.56' Storage=270 cf Inflow=0.23 cfs 3,462 cf
Outflow=0.11 cfs 3,462 cf

Pond 6P: Infiltration Basin C Peak Elev=443.94' Storage=89 cf Inflow=0.06 cfs 923 cf
Outflow=0.03 cfs 923 cf

Summary for Subcatchment 3S: Post Basin A-B

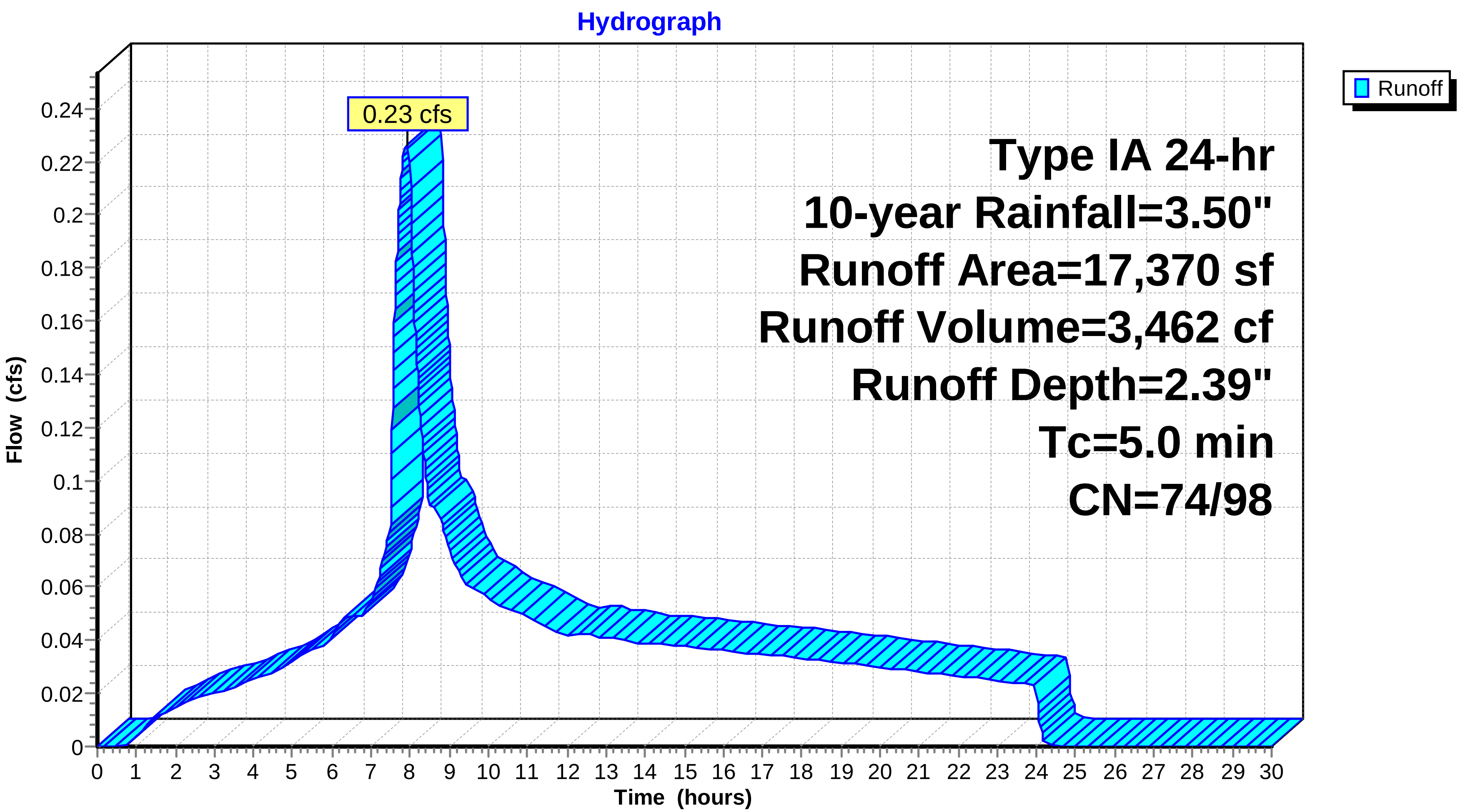
Runoff = 0.23 cfs @ 7.91 hrs, Volume= 3,462 cf, Depth= 2.39"
Routed to Pond 4P : Infiltration Basin A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-year Rainfall=3.50"

	Area (sf)	CN	Description
*	5,500	98	Paved parking, walkways, HSG B
*	3,600	98	Roofs, HSG B
*	3,340	60	Landscape>75% Grass cover, Good, HSG B
*	2,870	96	Gravel surface, HSG B
*	770	98	Basin - Wet (up to Elev. 444)
*	1,290	60	Basin, landscape, grass, above Elev. 444
	17,370	88	Weighted Average
	7,500	74	43.18% Pervious Area
	9,870	98	56.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, ODOT DELAY TO START OF RUN-OFF**

Subcatchment 3S: Post Basin A-B



Summary for Subcatchment 5S: Post Basin C

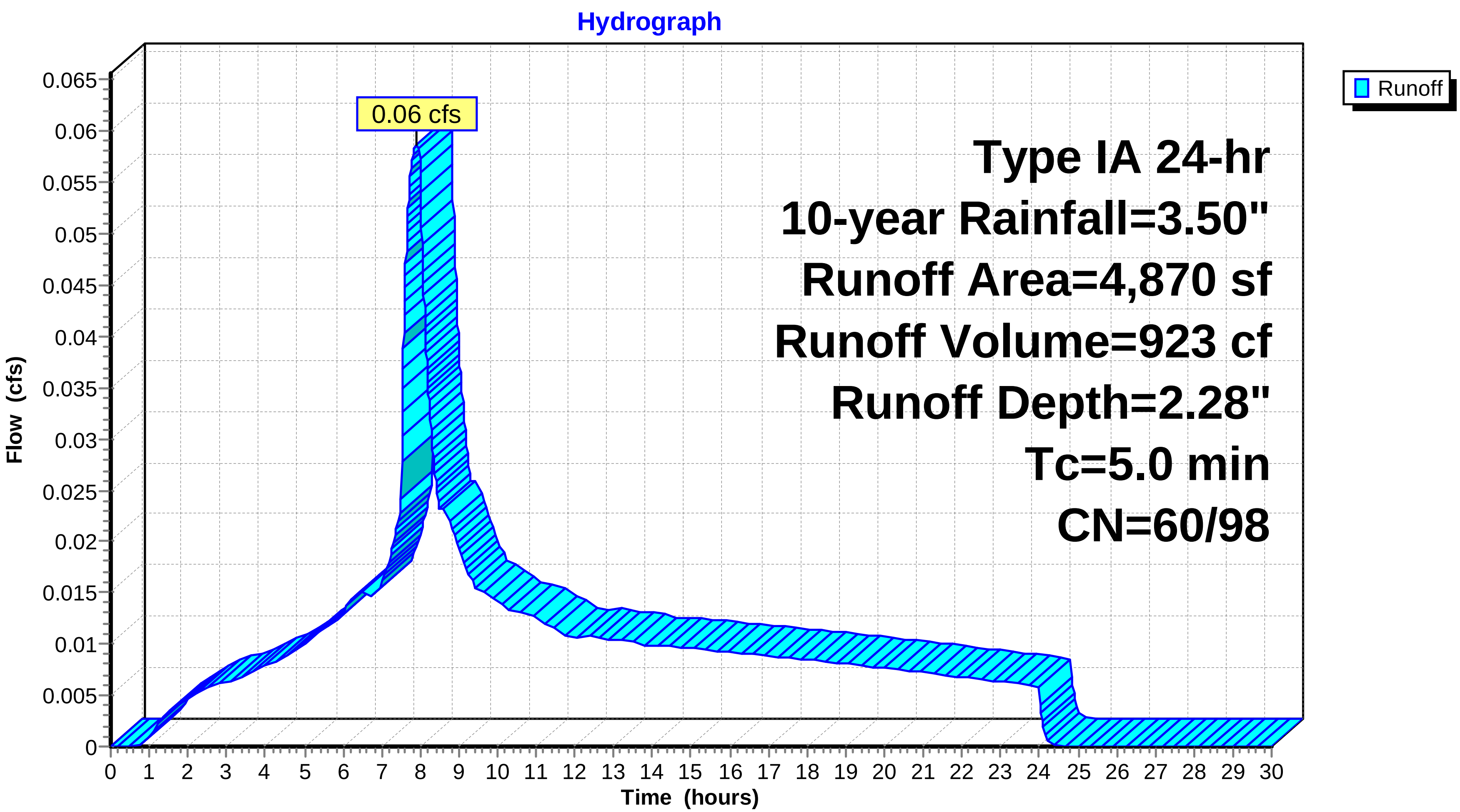
Runoff = 0.06 cfs @ 7.89 hrs, Volume= 923 cf, Depth= 2.28"
Routed to Pond 6P : Infiltration Basin C

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-year Rainfall=3.50"

	Area (sf)	CN	Description
*	2,005	98	Paved parking, walkways, HSG B
*	600	98	Roofs, HSG B
*	1,310	60	>75% Grass cover, Good, HSG B
*	500	98	Wet Basin, Up to Elev 445
*	455	60	Landscape basin above Elev 445 >75% grass cover HSG B
	4,870	84	Weighted Average
	1,765	60	36.24% Pervious Area
	3,105	98	63.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, ODOT DELAY TO START OF RUN-OFF**

Subcatchment 5S: Post Basin C



Summary for Pond 4P: Infiltration Basin A

Inflow Area = 17,370 sf, 56.82% Impervious, Inflow Depth = 2.39" for 10-year event
Inflow = 0.23 cfs @ 7.91 hrs, Volume= 3,462 cf
Outflow = 0.11 cfs @ 8.32 hrs, Volume= 3,462 cf, Atten= 50%, Lag= 24.5 min
Primary = 0.11 cfs @ 8.32 hrs, Volume= 3,462 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 442.56' @ 8.32 hrs Surf.Area= 583 sf Storage= 270 cf

Plug-Flow detention time= 10.8 min calculated for 3,460 cf (100% of inflow)
Center-of-Mass det. time= 10.8 min (715.8 - 705.0)

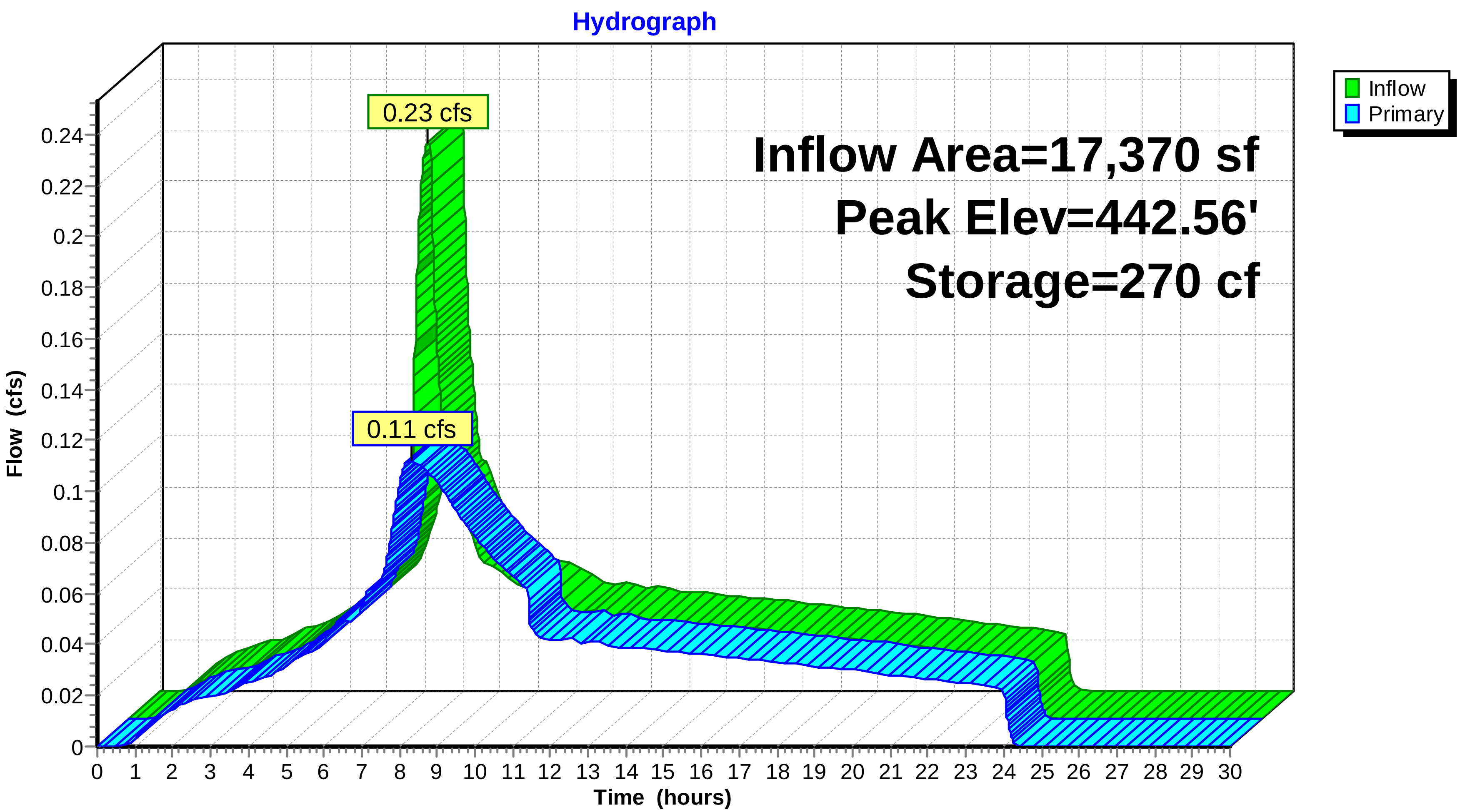
Volume	Invert	Avail.Storage	Storage Description
#1	442.00'	1,561 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
442.00	382	99.0	0	0	382
443.00	767	140.0	563	563	1,171
444.00	1,248	168.0	998	1,561	1,874

Device	Routing	Invert	Outlet Devices
#1	Primary	442.00'	**6.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 440.00'

Primary OutFlow Max=0.11 cfs @ 8.32 hrs HW=442.56' (Free Discharge)
└─**1=Exfiltration** (Controls 0.11 cfs)

Pond 4P: Infiltration Basin A



Stage-Area-Storage for Pond 4P: Infiltration Basin A

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
442.00	382	0	442.74	654	379	443.48	983	982
442.02	388	8	442.76	662	392	443.50	993	1,002
442.04	395	16	442.78	671	405	443.52	1,003	1,022
442.06	401	23	442.80	679	419	443.54	1,012	1,042
442.08	408	32	442.82	688	433	443.56	1,022	1,063
442.10	415	40	442.84	696	446	443.58	1,032	1,083
442.12	421	48	442.86	705	460	443.60	1,042	1,104
442.14	428	57	442.88	714	475	443.62	1,051	1,125
442.16	435	65	442.90	723	489	443.64	1,061	1,146
442.18	441	74	442.92	731	504	443.66	1,071	1,167
442.20	448	83	442.94	740	518	443.68	1,081	1,189
442.22	455	92	442.96	749	533	443.70	1,091	1,211
442.24	462	101	442.98	758	548	443.72	1,102	1,232
442.26	469	110	443.00	767	563	443.74	1,112	1,255
442.28	476	120	443.02	775	579	443.76	1,122	1,277
442.30	484	130	443.04	784	594	443.78	1,132	1,300
442.32	491	139	443.06	793	610	443.80	1,142	1,322
442.34	498	149	443.08	801	626	443.82	1,153	1,345
442.36	505	159	443.10	810	642	443.84	1,163	1,368
442.38	513	169	443.12	819	659	443.86	1,174	1,392
442.40	520	180	443.14	827	675	443.88	1,184	1,415
442.42	528	190	443.16	836	692	443.90	1,195	1,439
442.44	535	201	443.18	845	708	443.92	1,205	1,463
442.46	543	212	443.20	854	725	443.94	1,216	1,487
442.48	550	223	443.22	863	743	443.96	1,227	1,512
442.50	558	234	443.24	872	760	443.98	1,237	1,536
442.52	566	245	443.26	881	777	444.00	**1,248**	**1,561**
442.54	573	256	443.28	890	795			
442.56	581	268	443.30	899	813			
442.58	589	279	443.32	908	831			
442.60	597	291	443.34	917	849			
442.62	605	303	443.36	927	868			
442.64	613	316	443.38	936	886			
442.66	621	328	443.40	945	905			
442.68	629	340	443.42	955	924			
442.70	638	353	443.44	964	943			
442.72	646	366	443.46	974	963			

Summary for Pond 6P: Infiltration Basin C

Inflow Area = 4,870 sf, 63.76% Impervious, Inflow Depth = 2.28" for 10-year event
Inflow = 0.06 cfs @ 7.89 hrs, Volume= 923 cf
Outflow = 0.03 cfs @ 8.24 hrs, Volume= 923 cf, Atten= 44%, Lag= 20.7 min
Primary = 0.03 cfs @ 8.24 hrs, Volume= 923 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 443.94' @ 8.24 hrs Surf.Area= 181 sf Storage= 89 cf

Plug-Flow detention time= 24.5 min calculated for 923 cf (100% of inflow)
Center-of-Mass det. time= 24.5 min (712.8 - 688.3)

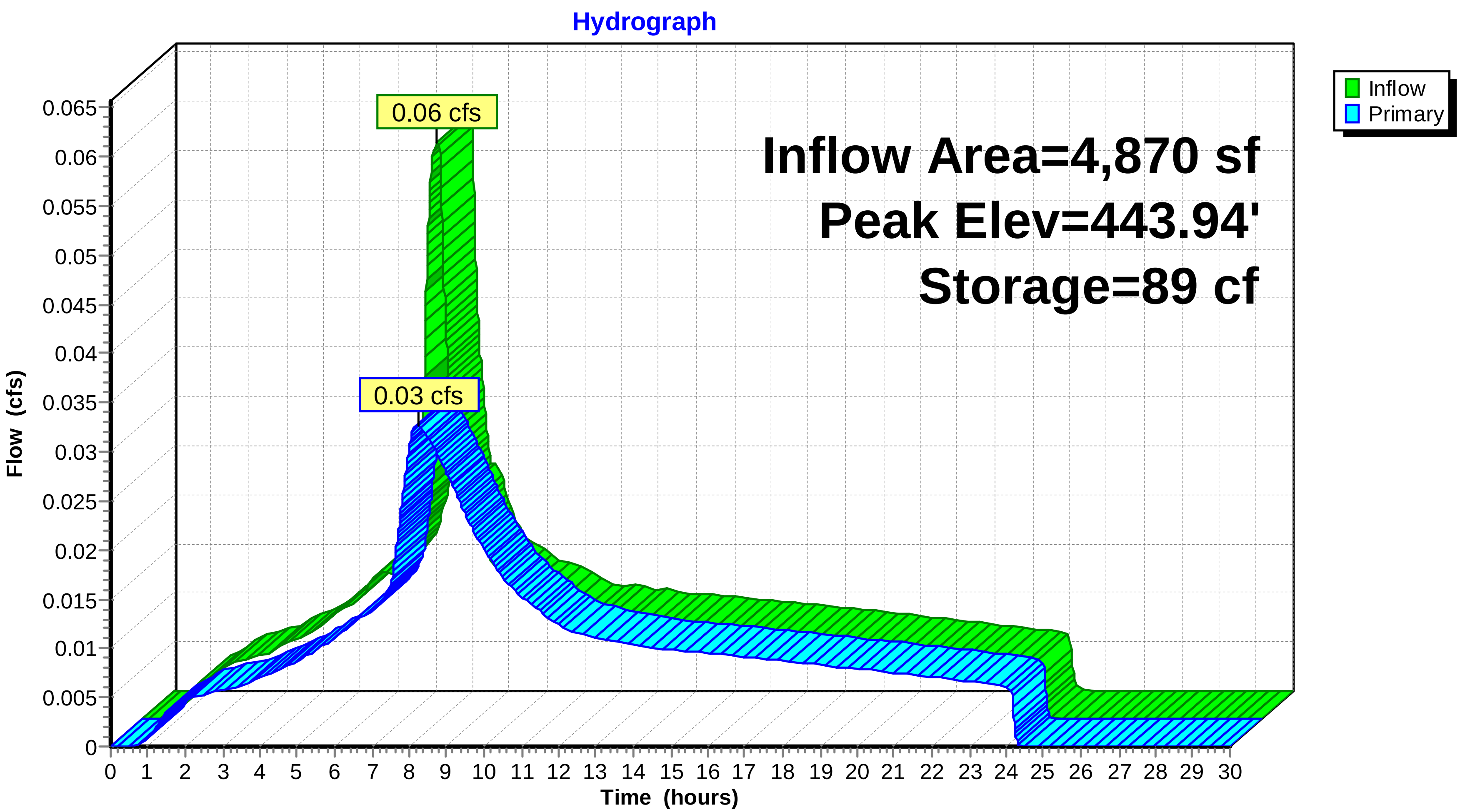
Volume	Invert	Avail.Storage	Storage Description
#1	443.00'	436 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
443.00	30	26.5	0	0	30
444.00	195	67.0	100	100	335
445.00	500	113.5	336	436	1,009

Device	Routing	Invert	Outlet Devices
#1	Primary	443.00'	**6.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 440.00'

Primary OutFlow Max=0.03 cfs @ 8.24 hrs HW=443.94' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Pond 6P: Infiltration Basin C



Stage-Area-Storage for Pond 6P: Infiltration Basin C

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
443.00	30	0	443.74	138	57	444.48	324	224
443.02	32	1	443.76	142	60	444.50	330	230
443.04	34	1	443.78	146	63	444.52	336	237
443.06	36	2	443.80	150	66	444.54	342	244
443.08	38	3	443.82	155	69	444.56	348	251
443.10	40	3	443.84	159	72	444.58	355	258
443.12	42	4	443.86	163	75	444.60	361	265
443.14	44	5	443.88	168	79	444.62	367	272
443.16	47	6	443.90	172	82	444.64	374	279
443.18	49	7	443.92	176	86	444.66	380	287
443.20	51	8	443.94	181	89	444.68	387	295
443.22	54	9	443.96	186	93	444.70	394	303
443.24	56	10	443.98	190	97	444.72	400	310
443.26	59	11	444.00	195	100	444.74	407	319
443.28	62	13	444.02	200	104	444.76	414	327
443.30	64	14	444.04	204	108	444.78	421	335
443.32	67	15	444.06	209	113	444.80	428	344
443.34	70	17	444.08	214	117	444.82	435	352
443.36	73	18	444.10	219	121	444.84	442	361
443.38	76	19	444.12	224	126	444.86	449	370
443.40	79	21	444.14	229	130	444.88	456	379
443.42	82	23	444.16	234	135	444.90	463	388
443.44	85	24	444.18	239	140	444.92	470	397
443.46	88	26	444.20	245	144	444.94	478	407
443.48	91	28	444.22	250	149	444.96	485	417
443.50	94	30	444.24	255	154	444.98	493	426
443.52	98	32	444.26	261	160	445.00	**500**	**436**
443.54	101	34	444.28	266	165			
443.56	105	36	444.30	272	170			
443.58	108	38	444.32	277	176			
443.60	112	40	444.34	283	181			
443.62	115	42	444.36	289	187			
443.64	119	45	444.38	294	193			
443.66	123	47	444.40	300	199			
443.68	127	49	444.42	306	205			
443.70	130	52	444.44	312	211			
443.72	134	55	444.46	318	217			

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 3S: Post Basin A-B	Runoff Area=17,370 sf 56.82% Impervious Runoff Depth=3.27" Tc=5.0 min CN=74/98 Runoff=0.31 cfs 4,740 cf
Subcatchment 5S: Post Basin C	Runoff Area=4,870 sf 63.76% Impervious Runoff Depth=3.09" Tc=5.0 min CN=60/98 Runoff=0.08 cfs 1,253 cf
Pond 4P: Infiltration Basin A	Peak Elev=442.86' Storage=458 cf Inflow=0.31 cfs 4,740 cf Outflow=0.15 cfs 4,740 cf
Pond 6P: Infiltration Basin C	Peak Elev=444.14' Storage=130 cf Inflow=0.08 cfs 1,253 cf Outflow=0.04 cfs 1,253 cf

Summary for Subcatchment 3S: Post Basin A-B

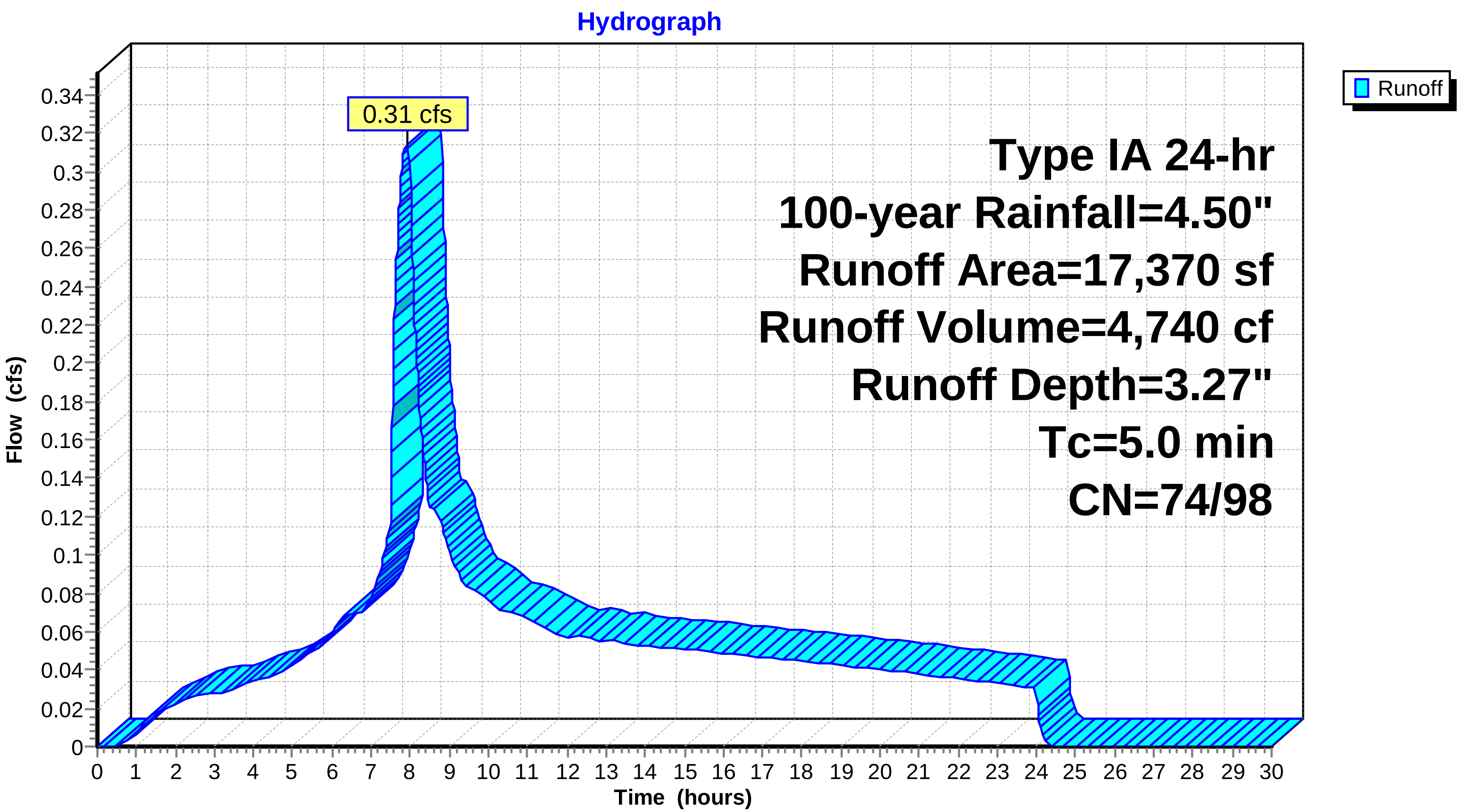
Runoff = 0.31 cfs @ 7.91 hrs, Volume= 4,740 cf, Depth= 3.27"
Routed to Pond 4P : Infiltration Basin A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Rainfall=4.50"

	Area (sf)	CN	Description
*	5,500	98	Paved parking, walkways, HSG B
*	3,600	98	Roofs, HSG B
*	3,340	60	Landscape>75% Grass cover, Good, HSG B
*	2,870	96	Gravel surface, HSG B
*	770	98	Basin - Wet (up to Elev. 444)
*	1,290	60	Basin, landscape, grass, above Elev. 444
	17,370	88	Weighted Average
	7,500	74	43.18% Pervious Area
	9,870	98	56.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, ODOT DELAY TO START OF RUN-OFF**

Subcatchment 3S: Post Basin A-B



Summary for Subcatchment 5S: Post Basin C

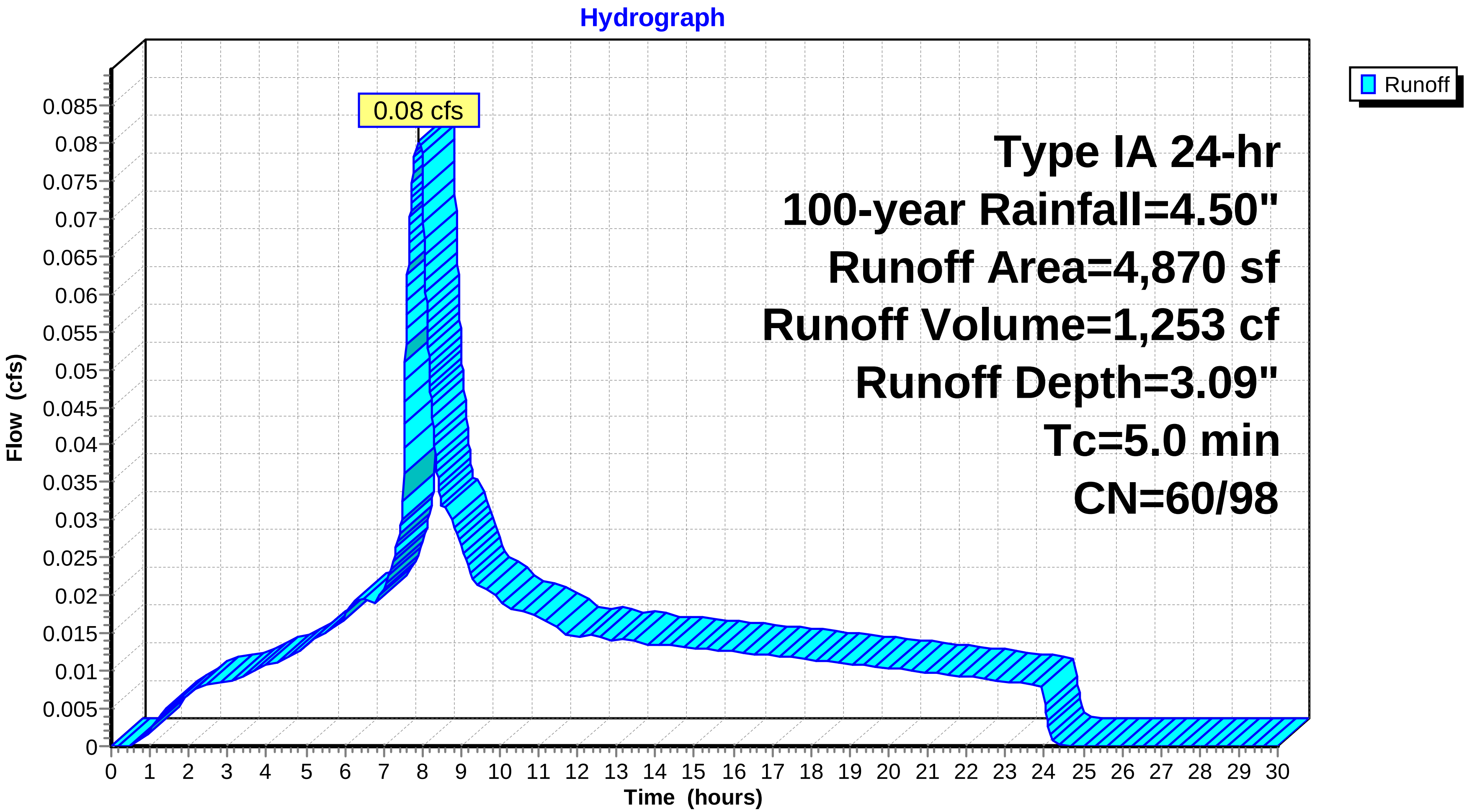
Runoff = 0.08 cfs @ 7.90 hrs, Volume= 1,253 cf, Depth= 3.09"
Routed to Pond 6P : Infiltration Basin C

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-year Rainfall=4.50"

	Area (sf)	CN	Description
*	2,005	98	Paved parking, walkways, HSG B
*	600	98	Roofs, HSG B
*	1,310	60	>75% Grass cover, Good, HSG B
*	500	98	Wet Basin, Up to Elev 445
*	455	60	Landscape basin above Elev 445 >75% grass cover HSG B
	4,870	84	Weighted Average
	1,765	60	36.24% Pervious Area
	3,105	98	63.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, ODOT DELAY TO START OF RUN-OFF**

Subcatchment 5S: Post Basin C



Summary for Pond 4P: Infiltration Basin A

Inflow Area = 17,370 sf, 56.82% Impervious, Inflow Depth = 3.27" for 100-year event
Inflow = 0.31 cfs @ 7.91 hrs, Volume= 4,740 cf
Outflow = 0.15 cfs @ 8.37 hrs, Volume= 4,740 cf, Atten= 54%, Lag= 27.5 min
Primary = 0.15 cfs @ 8.37 hrs, Volume= 4,740 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 442.86' @ 8.37 hrs Surf.Area= 704 sf Storage= 458 cf

Plug-Flow detention time= 17.5 min calculated for 4,738 cf (100% of inflow)
Center-of-Mass det. time= 17.5 min (717.0 - 699.5)

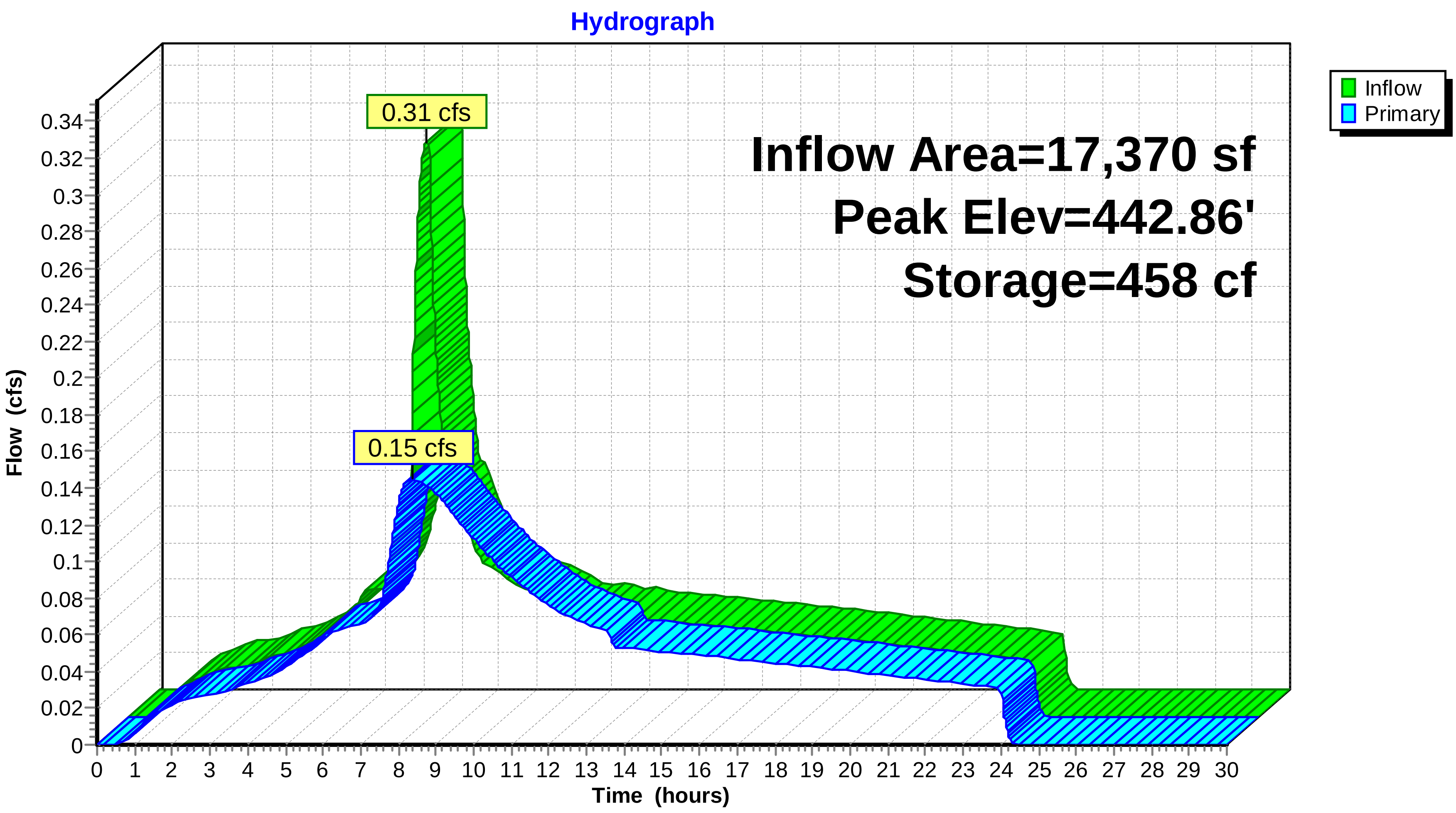
Volume	Invert	Avail.Storage	Storage Description
#1	442.00'	1,561 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
442.00	382	99.0	0	0	382
443.00	767	140.0	563	563	1,171
444.00	1,248	168.0	998	1,561	1,874

Device	Routing	Invert	Outlet Devices
#1	Primary	442.00'	**6.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 440.00'

Primary OutFlow Max=0.15 cfs @ 8.37 hrs HW=442.86' (Free Discharge)
└─**1=Exfiltration** (Controls 0.15 cfs)

Pond 4P: Infiltration Basin A



Stage-Area-Storage for Pond 4P: Infiltration Basin A

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
442.00	382	0	442.74	654	379	443.48	983	982
442.02	388	8	442.76	662	392	443.50	993	1,002
442.04	395	16	442.78	671	405	443.52	1,003	1,022
442.06	401	23	442.80	679	419	443.54	1,012	1,042
442.08	408	32	442.82	688	433	443.56	1,022	1,063
442.10	415	40	442.84	696	446	443.58	1,032	1,083
442.12	421	48	442.86	705	460	443.60	1,042	1,104
442.14	428	57	442.88	714	475	443.62	1,051	1,125
442.16	435	65	442.90	723	489	443.64	1,061	1,146
442.18	441	74	442.92	731	504	443.66	1,071	1,167
442.20	448	83	442.94	740	518	443.68	1,081	1,189
442.22	455	92	442.96	749	533	443.70	1,091	1,211
442.24	462	101	442.98	758	548	443.72	1,102	1,232
442.26	469	110	443.00	767	563	443.74	1,112	1,255
442.28	476	120	443.02	775	579	443.76	1,122	1,277
442.30	484	130	443.04	784	594	443.78	1,132	1,300
442.32	491	139	443.06	793	610	443.80	1,142	1,322
442.34	498	149	443.08	801	626	443.82	1,153	1,345
442.36	505	159	443.10	810	642	443.84	1,163	1,368
442.38	513	169	443.12	819	659	443.86	1,174	1,392
442.40	520	180	443.14	827	675	443.88	1,184	1,415
442.42	528	190	443.16	836	692	443.90	1,195	1,439
442.44	535	201	443.18	845	708	443.92	1,205	1,463
442.46	543	212	443.20	854	725	443.94	1,216	1,487
442.48	550	223	443.22	863	743	443.96	1,227	1,512
442.50	558	234	443.24	872	760	443.98	1,237	1,536
442.52	566	245	443.26	881	777	444.00	**1,248**	**1,561**
442.54	573	256	443.28	890	795			
442.56	581	268	443.30	899	813			
442.58	589	279	443.32	908	831			
442.60	597	291	443.34	917	849			
442.62	605	303	443.36	927	868			
442.64	613	316	443.38	936	886			
442.66	621	328	443.40	945	905			
442.68	629	340	443.42	955	924			
442.70	638	353	443.44	964	943			
442.72	646	366	443.46	974	963			

Summary for Pond 6P: Infiltration Basin C

Inflow Area = 4,870 sf, 63.76% Impervious, Inflow Depth = 3.09" for 100-year event
Inflow = 0.08 cfs @ 7.90 hrs, Volume= 1,253 cf
Outflow = 0.04 cfs @ 8.28 hrs, Volume= 1,253 cf, Atten= 47%, Lag= 22.3 min
Primary = 0.04 cfs @ 8.28 hrs, Volume= 1,253 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 444.14' @ 8.28 hrs Surf.Area= 229 sf Storage= 130 cf

Plug-Flow detention time= 31.0 min calculated for 1,253 cf (100% of inflow)
Center-of-Mass det. time= 31.0 min (718.3 - 687.3)

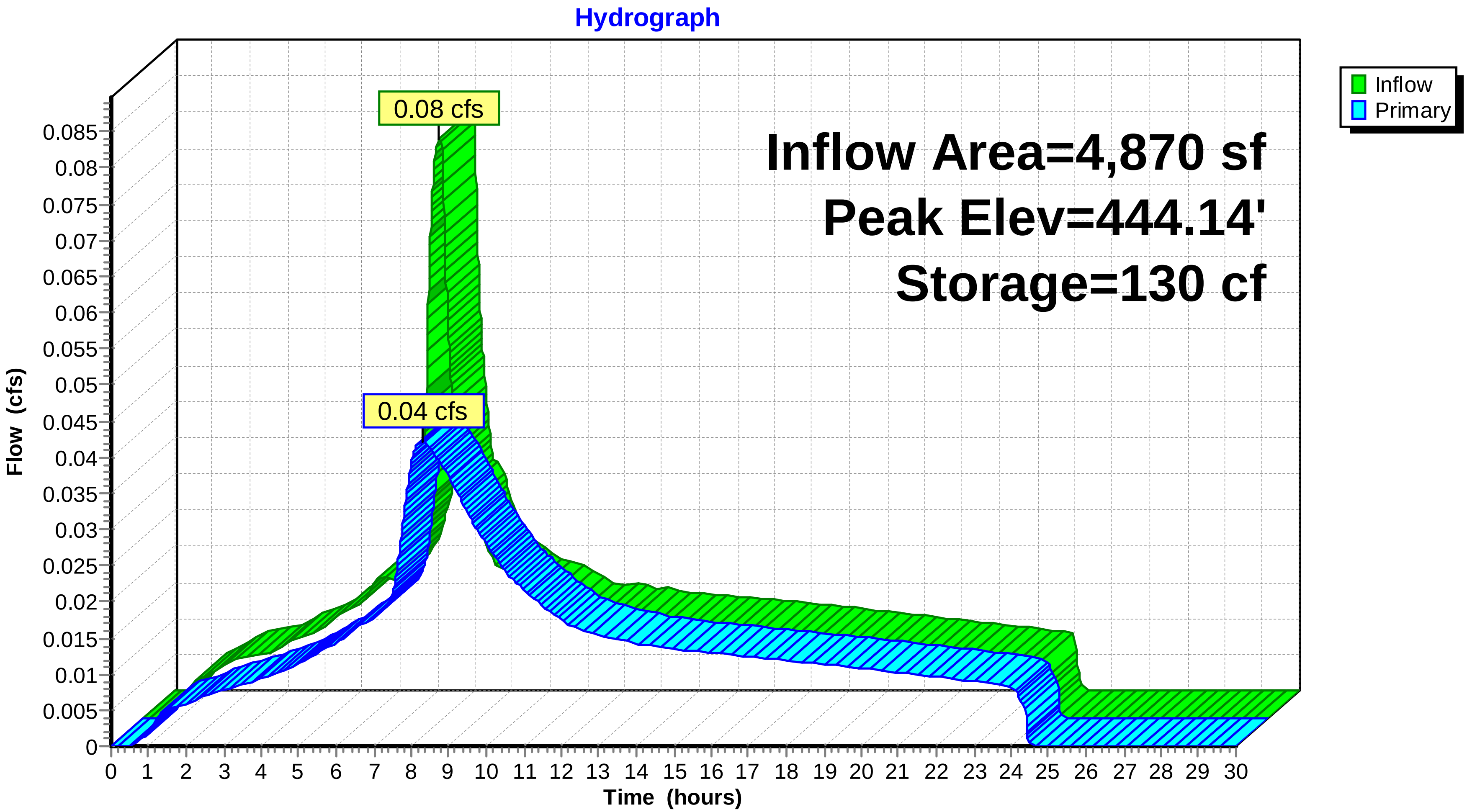
Volume	Invert	Avail.Storage	Storage Description
#1	443.00'	436 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
443.00	30	26.5	0	0	30
444.00	195	67.0	100	100	335
445.00	500	113.5	336	436	1,009

Device	Routing	Invert	Outlet Devices
#1	Primary	443.00'	**6.800 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 440.00'

Primary OutFlow Max=0.04 cfs @ 8.28 hrs HW=444.14' (Free Discharge)
└—**1=Exfiltration** (Controls 0.04 cfs)

Pond 6P: Infiltration Basin C



Stage-Area-Storage for Pond 6P: Infiltration Basin C

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
443.00	30	0
443.02	32	1
443.04	34	1
443.06	36	2
443.08	38	3
443.10	40	3
443.12	42	4
443.14	44	5
443.16	47	6
443.18	49	7
443.20	51	8
443.22	54	9
443.24	56	10
443.26	59	11
443.28	62	13
443.30	64	14
443.32	67	15
443.34	70	17
443.36	73	18
443.38	76	19
443.40	79	21
443.42	82	23
443.44	85	24
443.46	88	26
443.48	91	28
443.50	94	30
443.52	98	32
443.54	101	34
443.56	105	36
443.58	108	38
443.60	112	40
443.62	115	42
443.64	119	45
443.66	123	47
443.68	127	49
443.70	130	52
443.72	134	55
443.74	138	57
443.76	142	60
443.78	146	63
443.80	150	66
443.82	155	69
443.84	159	72
443.86	163	75
443.88	168	79
443.90	172	82
443.92	176	86
443.94	181	89
443.96	186	93
443.98	190	97
444.00	195	100
444.02	200	104
444.04	204	108
444.06	209	113
444.08	214	117
444.10	219	121
444.12	224	126
444.14	229	130
444.16	234	135
444.18	239	140
444.20	245	144
444.22	250	149
444.24	255	154
444.26	261	160
444.28	266	165
444.30	272	170
444.32	277	176
444.34	283	181
444.36	289	187
444.38	294	193
444.40	300	199
444.42	306	205
444.44	312	211
444.46	318	217
444.48	324	224
444.50	330	230
444.52	336	237
444.54	342	244
444.56	348	251
444.58	355	258
444.60	361	265
444.62	367	272
444.64	374	279
444.66	380	287
444.68	387	295
444.70	394	303
444.72	400	310
444.74	407	319
444.76	414	327
444.78	421	335
444.80	428	344
444.82	435	352
444.84	442	361
444.86	449	370
444.88	456	379
444.90	463	388
444.92	470	397
444.94	478	407
444.96	485	417
444.98	493	426
445.00	**500**	**436**